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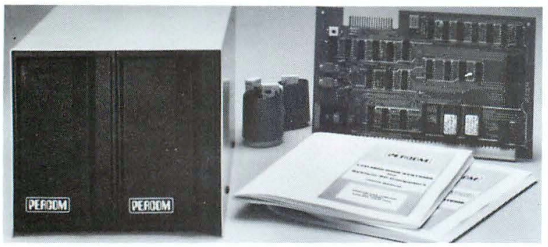
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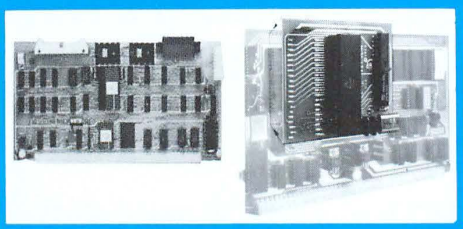
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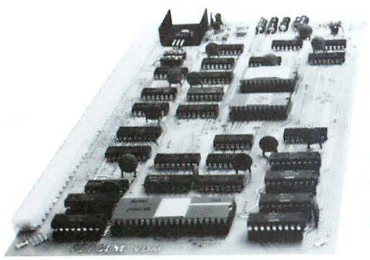
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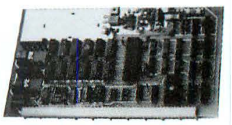
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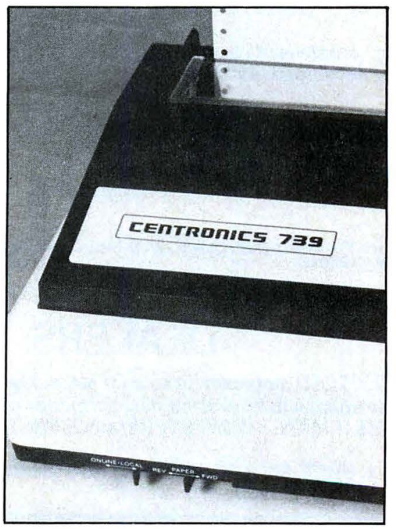
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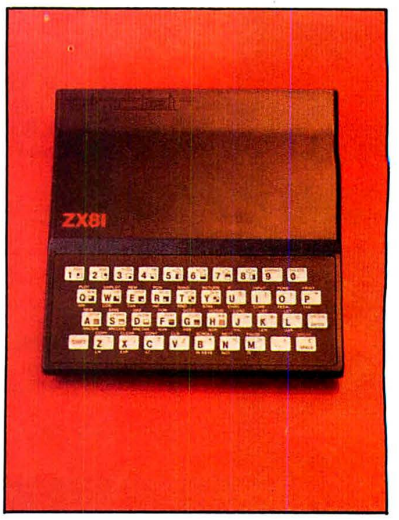
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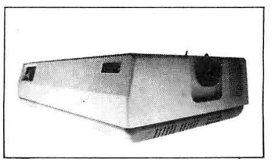
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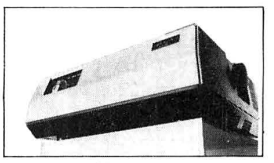
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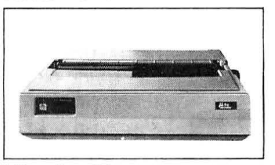
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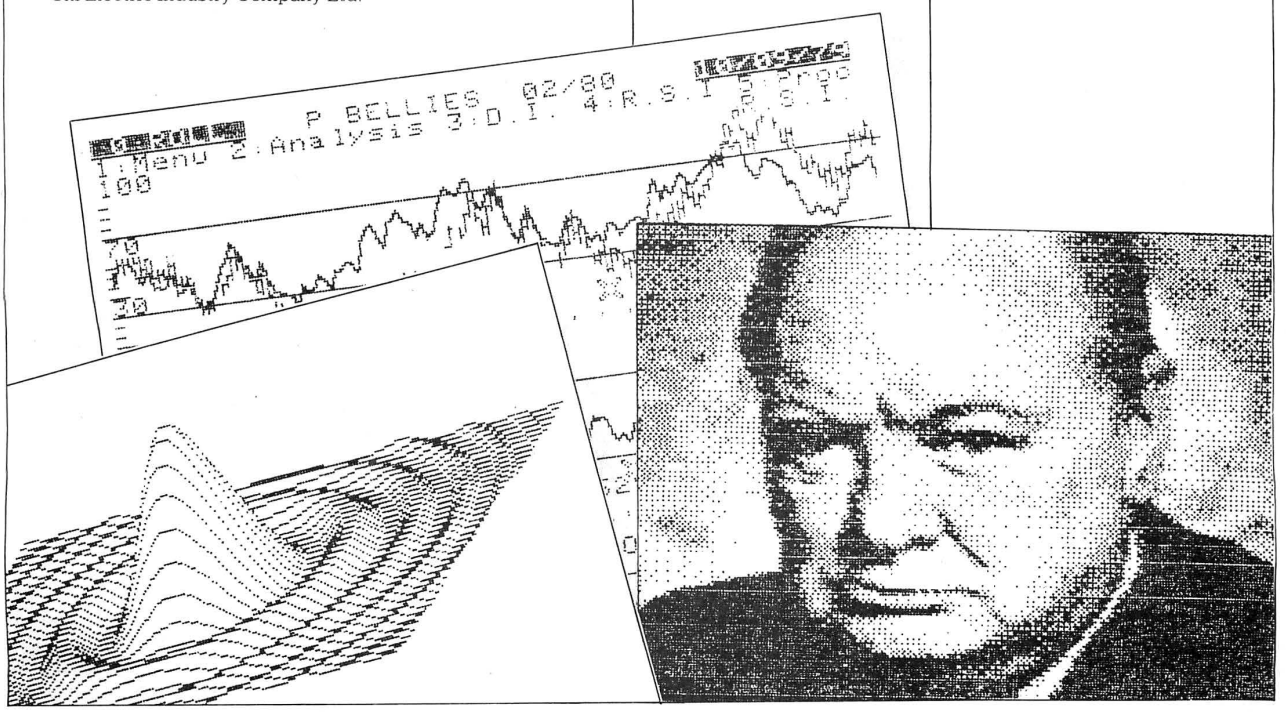
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By Wayne Green

Setting Type With Micros



Typesetting

A reader recently protested something I had written about typesetting unions opposing technological improvements. Having been in publishing for over 30 years now, I have been more than passingly interested in typesetting, and have kept up to date on it.

Up until about 15 years ago almost all type was set by the printing firms using the Mergenthaler Linotype machine. The typesetters union was a very powerful one. When I started my first big magazine, *73*, back in 1960, it was printed by O'Brien Press in New York. This was once the largest publication printer in the country. When I started working with them I found them saddled with a large number of 40-year veterans of typesetting. You had to be the son of a union member to join, they claimed, and also pay an incredible initiation fee (like $25,000, which was a lot of money in 1960).

This group was dedicated to featherbedding and made work with a diligence that was hard to believe. They would fight to the death against anything which would take away a job. They spent days rekeyboarding material as called for in their union rules.

Whenever a newspaper wanted to try out any automated typesetting systems such as punched tape for the Linotype or Varityper systems, the matter quickly came to strike proportions—supported by the other printing trade unions. Not only did the strength of these unions keep technology at bay for years, their insistence on maintaining low productivity forced more and more publishers out of business.

This intransigence cost printers the whole typesetting market. As I said, it wasn't long ago that virtually all type was being set by printers. The Varityper broke the ice. But it wasn't a very good piece of equipment, so it didn't make much of an impact. The big change was when IBM came out with their Composer.

> Today there are few publishers who don't set their own type, and few printers who do much typesetting.

Since the unions didn't allow printers to install the IBM Composers, publishers, faced with the age-old costs and slowness of Linotype, quickly picked up on the IBM system as a way to cut typesetting costs substantially. Also, doing the work in-house sped it up, making last-minute changes much simpler and less expensive.

For the first few years of *73* we had all of our type set in lead with the Linotype systems. Then, when an issue of the magazine was about ready to go to press, someone from our offices (often it was I) would have to drive to the printing plant and work for a couple of days to correct errors and get the magazine ready for printing.

We were one of the early magazines to change to the IBM system, starting out around 1967 with a Composer to type each line of type twice—once to determine its length and the second to make it a uniform length based upon the first measurement. A few years later this process was done automatically and we changed to the new Composer.

Today there are few publishers who don't set their own type—and few printers who do much in the way of typesetting. The unions killed a very big industry for the printers. It isn't as efficient for most publishers to use this in-house typesetting, but there isn't a lot of choice today. So many publishers do typesetting that there is only a relatively small market for contract typesetting, and thus the costs are relatively high. We find that we can set type at about half the cost of having it done outside.

Microcomputers Help

Most of the better typesetting systems today have an interface for accepting input from microcomputers. An increasing amount of the keyboarding for our publications is brought in on disk from the authors. Other material is written by editors on TRS-80 systems and fed directly to the typesetting system. In another year we expect at least 75 percent of our keyboarding of magazine material to come in on disk, on cassette or over phone lines. This material will then be edited on microcomputers and then fed into the typesetting system.

We are evaluating new typesetting systems. We started with a Compugraphic typesetter a few years ago when IBM failed to keep up with technology and their Composer systems were no longer competitive. Then, as we grew, we kept adding more Compugraphic systems.

Last year, after having massive problems keeping up with our typesetting needs, we studied the situation and found that we had fallen behind again. We were experiencing catastrophic failures of the Compugraphic systems, with four out of five of them being down at times. We found that the cost of repairs was more than the cost of the equipment, by a rather wide margin. We found our magazines being delayed by the breakdowns in the Compugraphics, with a resulting loss of advertising attributable to that situation on the order of $3M or more. You know, a few million here, a few million there, and soon you are talking about real money.

With our publishing venture growing at about 50 percent per year, it has been a constant problem trying to keep up with facilities and people. We've expanded from one very old house to six buildings for work plus a couple more for storage. The graphic arts department has been expanded and modernized, with three

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large darkrooms and automatic film processing.

With many of the other publishers collapsing around me, I guess I have nothing to complain about. *Byte* had to sell out. *Creative* had to sell out. *Personal* had to sell out. *Interface* seems to be having insurmountable troubles. Golly, I'm the *only* one still around.

Those Confounded Arcade Games

There has been an increasing uproar over the way arcade games have been addicting our kids. The quarters pour into the games, making the arcade owners, the owners of the games and the manufacturers rich.

Having been addicted to computer games myself, I can understand the psychology involved. That's a dark side of my past that I have heretofore kept secret. But to provide myself as an example of what can happen—and to prove that total reformation is possible—I offer myself for inspection.

Perhaps I can throw myself on your mercy in this, pleading extreme youth. Others will unkindly point out that there is little proof that I am not still suffering from extreme youth. Well, some of us mature late. Perhaps this year (60) will be a winner and I will grow up. I hope not.

It all started while I was in the Navy back in 1943. I was going to school at Treasure Island in San Francisco, taking a crash course in electronics and radar repair. Not permitted off the island except on weekends, I found myself with time to kill in the evenings and soon gravitated to the arcade games at the ship's service building, which featured particularly fiendish hockey games for a nickel.

I have a sense of competitiveness that gets me into trouble all the time. All it took was for someone to start playing on one of the hockey games and formerly tightwad Green would jump to the other machine to try and beat him out. It wasn't long before I could rack up a perfect score every time. Then I started running both machines at once and worked at it until I could get perfect scores on both simultaneously.

Now, where does an enterprising youth go from there? I started working 'em behind my back, going by the sound of the balls hitting to know when to have which hockey player swing. In a couple of weeks I could run both at once behind my back and get perfect scores. There was no more competition by this time, just performances and applause. I retired and took up poker.

I thought I had managed to kick the habit, but when the first of the electronic games came along my recidivist tendencies dragged me back into the arcades. It was those tank games that got me. I was innocently walking along the boardwalk at Atlantic City, resting between sessions at the first Computer show in 1976. A tank game pusher grabbed my arm and asked me just to try it . . . and that was it. I was throwing quarters into the machine as fast as I could, jumping around with glee as I shot all my opponents apart.

Reason—and a passionate love of quarters—prevailed, and I have managed to steer clear of those dens of iniquity since then.

Well, I wanted to share this part of my checkered past with you in the hopes that any addictees to arcade games will take heart and try to kick the habit. It *can* be done.

Program Protection

The technological war between program publishers and program stealers is warming up. I like the recent idea of selling a program with a demonstration disk as an addition. If the buyer likes the demo all he has to do is go back to the store, pay the remainder of the program price and receive a key to unlock the program itself.

The store thus has a smaller investment in the program before the sale, enabling the store to keep a larger inventory of programs on hand. When the customer comes in and pays the remaining part of the program price, the store calls the publisher and gets the specific key for that particular disk over the phone, allowing it to be used.

We'll be seeing more of these creative protection systems, I'm sure.

A couple of publishers are experimenting with a protection system that causes the computer to blow itself up if an illegal copy of the program is attempted. There is some question of legal liability in this instance which has been slowing down the use of the idea.

If a user buys a program that clearly states—on the program package, in the documentation and on the disk—that attempting to copy the program can destroy the computer, one wonders if this is enough warning to protect the publisher. It would be possible to also include a routine that warns the program user on the screen that if ordinary copy methods are attempted, further fooling around can cause the computer to self-destruct. Thus there would be no question about accidental damage to the system.

Since this is a situation without precedent, the usual advice from lawyers is not to try it. How about it, lawyers?

Control Keys

One of the major differences between microcomputers used for word processing and computer systems which are made specially for WP application is an extra row of keys for special functions.

Micros generally have most of the same functions, but you have to access them by touching two keys at the same time. That slows things down.

If you think about this for a short while (doesn't take long), you'll realize that when you are using the word processing function of your computer it is highly unlikely that you will have to use the ten-digit keypad at the same time. Voila! Ten to 12 special function keys sitting right there, ready for use.

In some systems these keys can be changed in their function by software, but with most systems it is going to take a slight hardware modification. This is an excellent business opportunity for a small company to package conversion kits with new keys to put on the switches which will show the functions as well as the numbers. In this way you can use the keypad when the computer is being used for numerical input, but can switch to the word processor function when the keys are needed for that.

Conversions should be possible for most computer stores to install once the parts kit, instructions and software are available from some firm. That's a lot easier solution to the problem than either making do with the escape functions or adding a separate keypad.

Well, there's your new business of the month . . . get going.□

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Most small system users think all microcomputers are created equal. And they're right. If you want performance, convenience, styling, high technology and reliability (and *who doesn't?*) your micro usually has a price tag that looks more like a mini. It seems big performance always means big bucks. But not so with the SuperBrain!

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You'll also get a full ASCII keyboard with an 18 key numeric pad and individual cursor control keys. Twin RS232C serial ports for fast and easy connection to a modem or printer. Dual Z80 processors which operate at 4 MHZ to insure lightning-fast program execution. And the list goes on! Feature after feature after feature.

Better yet, the SuperBrain boasts modular design to make servicing a snap. A common screwdriver is about the only service tool you'll ever need. And with the money you'll save on purchasing and maintaining the SuperBrain, you could almost buy another one. For under $3,500, it is truly one of the most remarkable microcomputers available anywhere.

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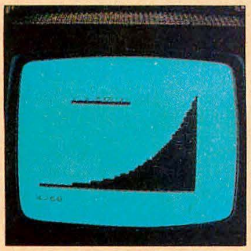
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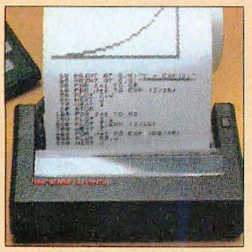
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**Does not apply to ZX81 kits.



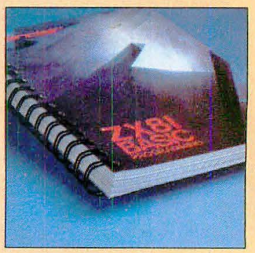
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By Robert W. Baker

Resurgence At Commodore

Gearing Up For the Competition

Plenty of Commodore News

During January and February there was a flurry of activity and new product announcements from Commodore. Most of this activity centered around the 1982 Consumer Electronics Show in Las Vegas during early January. Some of the announcements were of enough interest to spark a sizeable article in *The Wall Street Journal*. Anyway, here's a quick summary of the 12 press releases that were distributed by Commodore. I haven't been able to get my hands on most of the items since they're too new, so keep in mind that my information comes from press releases; many of the products may not yet be available. I'm sure you'll see plenty of advertising once they are available.

UCSD Pascal

First of all, Commodore is now offering an implementation of UCSD Pascal Version IV.0 (P-System) for its CBM systems, with a selling price of $175. The UCSD P-System was developed by SofTech Microsystems, Inc., under exclusive licensing rights from the University of California at San Diego, which developed the original UCSD Pascal portable system.

Version IV.0 is the latest implementation of the UCSD P-System, and has already proved popular with more than 30,000 end users. In the new P-System, all sections of code, including main programs and sections of the operating system, are treated as segments and move in and out of memory as needed. This provides greater system efficiency in the use of memory.

The UCSD P-System IV.0 runs on Commodore systems with the new 64K RAM card, and offers numerous advantages over the less powerful II.0 version that runs on Apple systems. Because the system has an enhanced memory capacity of 96K, the P-System uses RAM as if it were a disk unit. This provides more efficient storage of frequently-used program segments, menus and other program, system or applications parts.

Other advantages of the Version IV.0 over II.0 on the Apple include complete compatibility with all other UCSD users, such as Texas Instruments, IBM, Philips and Zenith, and a multi-tasking capability. Program units can be linked dynamically at run time, rather than having to link them prior to running, and unlimited segments are allowed, while Version II.0 permits only 32 segments. Version IV.0 also contains a debugger, which does not exist in Version II.0.

The P-System on Commodore equipment will support the CBM model 8032 business computer when used with a 64K RAM card. Commodore model 4040 and 8050 disk drives are supported as well as IEEE and serial printers. Documentation with the system includes an easy-to-use UCSD P-System user's manual. An internal architecture guide and an installation guide are also available.

VIC Programmers Reference Guide

The *VIC Programmers Reference Guide* provides complete information about the operation and programming of Commodore's VIC-20 home computer. The new programmer's guide was compiled from the experience of Commodore's international programming staffs in more than half a dozen countries, and is designed for use by both experienced and first-time computerists. The new manual lists for $16.95.

To cover areas programmers are most interested in, the book is divided into four sections. The reference guide's complete dictionary includes Basic commands and sample programs. The layman's overview to machine-language programming gets you started writing machine code. The interface section shows how to expand the VIC-20 for telecommunications, joysticks, game paddles and light pens. Programming graphics and sound is covered in the final section.

Teach Yourself Programming Series

The first in a series of teach yourself programming courses is an Introduction to Basic Programming, which provides a thorough introduction to Basic programming on Commodore's VIC-20 home computer. It comes complete with a self-study guide and two cassette tapes containing sample programs that run on the VIC-20. Even though the course relates to programming on the VIC-20, the concepts presented can be transferred to any other system, large or small.

The course is split into 15 units, each taking an evening's work. Most units require reading, practical work with the VIC-20 and some programming. Experiments included within each unit reinforce the concepts presented. A self-test questionnaire at the end of each unit measures how well you understand the unit. Retail price of the Introduction to Basic Programming is $24.95.

Home Calculation Six-Pack

The new Home Calculation six-pack for the VIC-20 consists of six cassettes containing Personal Finance, VIC Typewriter Word Processing, Expenses, Loan and Mortgage, and Home Inventory programs. The cassettes sell separately for $14.95; the six-pack is $59.95.

Personal Finance is a two-tape set that lets the user budget expenses. The VIC Typewriter is a mini word processor that uses the VIC-1515 Graphics Printer. The Expense Calendar program tracks important income and expense records, as well as pertinent personal dates, which can be recorded and displayed at any time. The Loan and Mortgage Calculator lets VIC users calculate the effects of different interest rates; it provides amortization schedules and can calculate variable

Address correspondence to Robert W. Baker, 15 Windsor Drive, Atco, NJ 08004.

rate mortgages to help you make the best choices. The Home Inventory program provides an effective method of listing all home belongings. It's ideal for insurance needs, and lets you categorize items by serial number or value.

The Home Calculation program package is Commodore's second six-pack of cassettes. Also available is a program pack of recreation tapes. In addition to the recreation and home utility categories, Commodore offers prerecorded programs for education, business or programming.

VIC Cartridge Games

Commodore has also announced seven new color cartridge games featuring computer-quality graphics, resolution, sound effects and exciting play action. The cartridges plug directly into the VIC-20 and offer home computer users arcade-style action in the comfort of their homes. The new games—Jupiter Lander, VIC Avenger, Superslot, Draw Poker, Super Allen, Midnight Drive and Magic Mouse—retail for $29.95 each.

VICModem

The lowest-priced modem in the personal computing industry was introduced by Commodore during the Consumer Electronics Show in January. The new VICModem, which retails for $109.95, is an easy-to-use plug-in cartridge that connects directly to the user port of the VIC-20 and can be used with any modular telephone. It's a direct-connect, 300-baud modem with originate/answer and half/full-duplex capabilities.

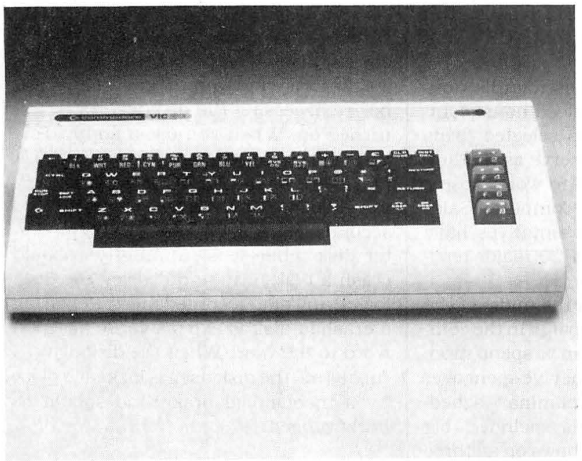
The VICModem lets you communicate and exchange data with other computer users over the telephone. This latest VIC peripheral also permits access to telecomputing networks such as The Source or CompuServe, which provide stock quotes and company reports, newswire stories, research data, sports scores, airline reservations, shopping services and more.

VIC Memory Expansion

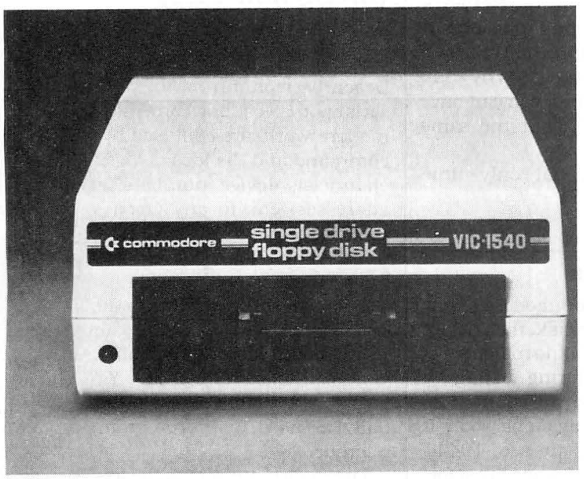
The VIC-1110, a memory expander for the VIC-20 that will retail for $59.95, was introduced. It plugs directly into the memory expansion port of the VIC-20 and adds 8192 bytes of memory. In addition to the VIC-1110, a 3K memory expander called the VIC-1210 is also available at a cost of only $39.95.

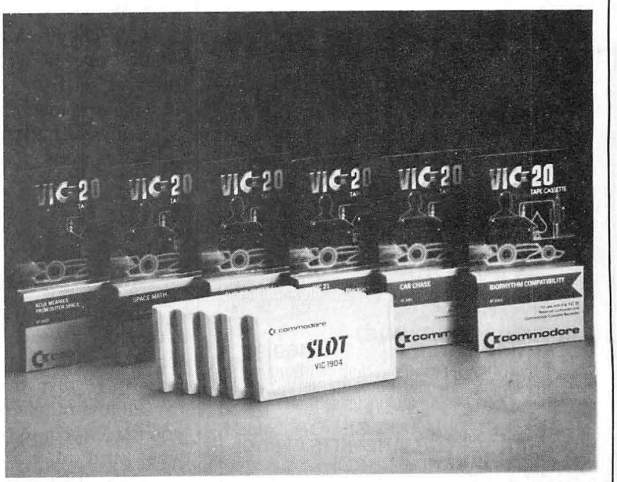
New Machines

Commodore will offer the widest range of home computers in the industry this spring, when it introduces two low-priced programmable color computers to complement its line. The two new home computers—the Commodore Ultimax and the Commodore-64—will play video games, compute and even synthesize music through hookups with stereo and hi-fi systems! They were demonstrated for the first time at the Consumer Electronics Show in Las Vegas during early









The VIC20 is a full-featured programmable color computer as well as a video game machine. At upper left is the VIC20, while at upper right is an array of VIC peripherals including the VIC 1540 single-drive floppy disk, VIC 1515 graphics printer, VIC Datasette tape recorder, cartridges and cassettes, and a new communications modem. At lower left the new VIC 1540 single-drive floppy disk is shown, while at lower right is an assortment of games and educational and entertainment cartridges and cassettes for the VIC.

January.

The Ultimax will be introduced at a suggested retail price of $149.95. It's a programmable color computer that will compete head-on at the retail level with Atari VCS and Intellivision video games, which do not offer computing capability. Easily connected to any color TV set, the Commodore Ultimax will feature a flat membrane keyboard and programming in Basic, and will use both cartridges and cassettes for games, programming and music synthesis. It will be compatible with joysticks, paddles and light pens, use the VIC Datasette tape recorder for program storage, and serve as a sound generator for polyphonic tones and music synthesis.

The Commodore-64, which will have a suggested retail price of $595, is an advanced home computer that will compete with others like the Atari 800 and Apple II+. It is programmable with a CP/M option, and has 64K of memory—well in excess of the competition in its immediate price range. The Commodore-64 will also have a full 66-key typewriter keyboard with upper- and lowercase capability, function keys, graphic characters, smart peripheral devices, a cartridge game slot and game controllers. Its audio abilities will include sound generation, polyphonic tones, music synthesis and hi-fi output.

Concurrent with the introduction of the two new products, Commodore announced that an expanded-memory version of its popular VIC-20, the SuperVIC with 16K of memory, will be introduced in the spring. This should provide Commodore with the most comprehensive range of home computers in the world today.

According to Kit Spencer, this tremendous leap forward in competitively-priced home computer technology is made possible by Commodore's unique in-house design and manufacture of microprocessor chips. In fact, chips of their design are currently being used today by many of their competitors worldwide. With home computers becoming more and more popular each day and truly becoming fixtures in the American home, Commodore expects to manufacture and bring to market as many computers in 1982 as the entire computer industry did in 1981.

New Marketing Organization

In a major plan to further expand its penetration of the booming home and professional microcomputer marketplaces, Commodore has restructured its marketing organization again. Two new divisions were created and are charged with marketing the company's four levels of home and personal computers. The new Home Computer Sales Division will market Commodore's low-priced line of home computers, including the VIC-20, as well as other new products planned for 1982. Commodore's Professional Computer Sales Division will market the company's PET, CBM and SuperPET computers.

Seeking the widest possible distribution for its line of low-priced home computers, Commodore has selected firms throughout the U.S. to serve as marketing representatives and to work closely with their new Home Computer Sales Division. To date, representatives have been appointed in 13 of 20 major territories in the U.S.

Commodore is also in the midst of the biggest advertising campaign in the company's history—they plan to spend more on this campaign than they've spent over the last 24 years! The preliminary schedule of TV commercials included big events and prime time shows on all three major networks and the Entertainment and Sports Programming Network (ESPN). They're attempting to reach virtually every household in the U.S. with their advertising message: "Why buy just a game machine when you can have a home computer for about the same price?"

It all sounds good, but only time will tell.

Winchester Disks

I recently received Commodore's new 5-megabyte Winchester disk, the D9060, for beta site testing. So far no major problems have turned up during testing by myself and others across the country, so you can expect to see it available soon. It was kind of exciting to see 19441 BLOCKS FREE displayed when I first formatted the disk. By the way, it only took about seven minutes to format the entire disk; program load times are so short you hardly notice. Don't forget, there's a 7.5-megabyte version that will also be available. This should really open up some new areas for the CBM systems in business and educational applications.

If you are considering using a Winchester disk, be sure to consider backup procedures. The Winchester disk is a nonremovable medium—you can't remove the disk from the drive because it's a sealed unit. You will only have one copy of anything on the disk unless you back it up. Backing up to cassette is not even worth considering and the 4040 disk is about as bad. It would take more than 30 4040 disks to back up the 5M-byte Winchester. Just think how long that would take you!

Currently the only tenable backup for either Winchester is the 8050 or 8250 disk. Even so, it will take at least 12 8050 disks to back up the 5M-byte Winchester. Current estimates indicate this would take at least five hours; and if you happen to have a file that's too large to fit on a single disk, there's no way to back it up. I hope someone will come up with a solution. A high-speed, high-capacity cartridge tape drive would probably be ideal.

One last comment on the new Winchester disks. You'll have to remember to let the disk come up to operating speed before accessing the disk when it's first turned on. When you use a floppy disk, you can turn on the unit, throw in a disk and away you go. Not so with a Winchester—you have to wait at least 20 to 30 seconds. Also, if you move the Winchester disk while it is running, you could crash a disk head and destroy the disk, losing any data recorded there. Repairing a crashed disk is expensive, so accept a word to the wise. When the disk drive is turned off, the disk itself is locked in place by a mechanical brake and should be fairly rugged.

VIC RS-232 Notes

Many people have written in the past few weeks since the appearance of my December column on the VIC's RS-232 serial port. Most newcomers to the Commodore world are confused by the Open command and the idea of logical files (or channels), device numbers, secondary addresses, etc. In any Open statement the first three entries are the logical file number, the actual device number and the secondary address.

The logical file number is the number you want to use in your Get#, Input# and Print# commands. This number is up to you, within certain limits. You should probably number the logical files sequentially as used in the program for easy reference.

The device number is the assigned address of the actual device you want to use. The keyboard is device #0, the tape is device #1, the RS-232 port is device #2 (on the VIC only), the display screen is device #3, the Commodore printer is

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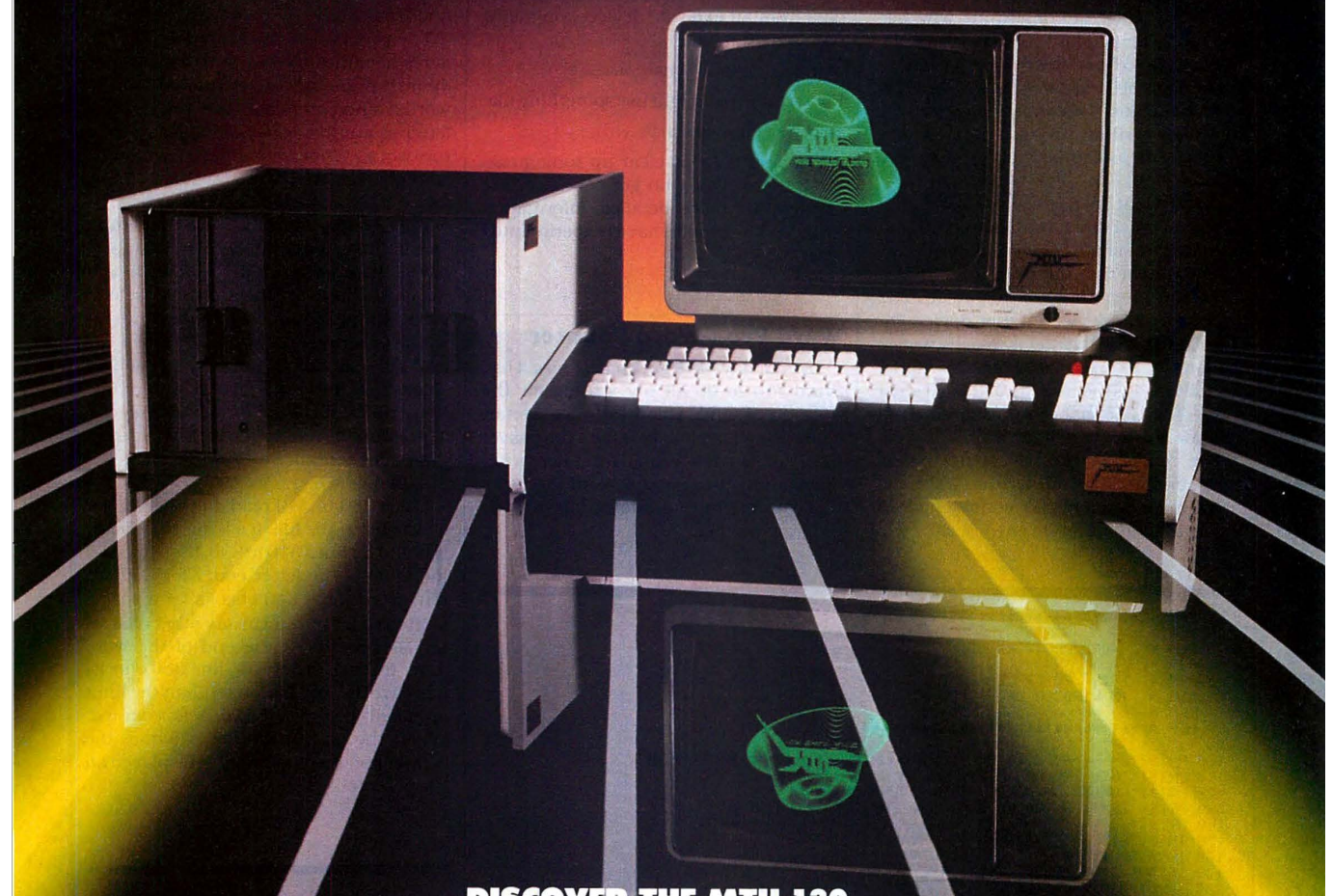
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device #4 and the disk is device #8. Except for the RS-232 port, these are standard for all Commodore systems. On all but the VIC, device #2 is the second cassette tape. Internal jumpers in all Commodore devices let you change the hardware-assigned device address if you want to.

The secondary address is an optional value used by some, but not all, devices. For example, the tape drive uses the secondary device to determine whether the file is for reading (0) or writing (1). On the RS-232 port, device #2, a secondary address of 0 indicates the serial port is to be read, and a secondary address of 1 indicates writing to the port. If not specified the secondary address usually defaults to 0.

If you want to use the RS-232 serial port, you must direct the Open command to device #2 no matter what device is actually attached to the port. Even if you have a printer attached to the RS-232 port, it is still device #2, not device #4. The Commodore printer is usually device #4 and uses the VIC's special serial peripheral bus (not the RS-232 port). Just because you are using a printer does not automatically make it device #4.

The first three entries of any Open command must be numeric, and the filename must be a string. You don't have to enter all three numeric entries; they will default to preset values if not specified. Remember that you can use variables and expressions however desired in the Open command. If you need to pass parameters in the filename field (as I mentioned in the RS-232 discussion) just create them as a string. The CHR$(xx) command is a handy way to enter decimal parameters such as those needed for the RS-232 controls.

To open an RS-232 channel for reading data from an external device, you might use something like

```
OPEN 1,2,0,CHR$(aa)+CHR$(bb)....
```

For writing you might use something like

```
OPEN 3,2,1,CHR$(xx)+CHR$(yy)....
```

I hope this helps clear up some areas for those of you who got confused. We can expect more detailed information after more people have experimented with the VIC.

Word Pro—Word Counter

As you may have guessed by now, I use Word Pro to do all my writing for the magazines and whatever else comes along. I've found it to be quite a time-saver over the past few years. Well, here's another utility program for Word Pro users that you might find interesting (see the program listing).

This short program counts the words in a given Word Pro text file that's been saved on disk. It will skip over all Word Pro commands and any nonalphanumeric characters in the text. You can specify the minimum number of letters a word must have to be counted. Thus you can choose to count only those words with four or more letters, and skip the shorter words. If you're doing school papers, writing classified ads, etc., you might find this handy.

The program is not foolproof, but it is fairly accurate. Words with hyphens or apostrophes are counted as single words, since any character that's not a letter or number is not counted as part of the word. Whenever a space or return (shown as a back-arrow in Word Pro) is found it's considered to be the end of the word. Groups of numbers are counted as words. The program does not support global files as currently coded. If you want to count all the words in a long piece, simply count each file separately.

The program flow is simple. Lines 100 to 200 do all the initialization. Line 240 skips the first two bytes of the file. Remember, the Word Pro text is saved in a program file (not a data file), and all program files contain the load address as the first two bytes.

Lines 280 to 340 read and check each character in the file. If a letter or number is found by lines 310 to 330, then line 270 increments the letter count for the current word. Line 340 checks for a space, shifted space or return; any other character is ignored. At the end of the word (after a space or return), line 360 checks whether the word is longer than the limit specified before the word is counted. When the end of the file is found, the number of words counted is displayed on the screen.□

```
10 REM ********************************
20 REM *
30 REM *   WORD PRO WORD COUNTER
40 REM *
50 REM *     BY: ROBERT BAKER
60 REM *  15 WINDSOR DR, ATCO, NJ
70 REM *
80 REM ********************************
90 :
100 PRINT"↵------  WORD PRO WORD COUNTER  ------":PRINT:PRINT
110 PRINT"THIS PROGRAM ATTEMPTS TO COUNT THE"
120 PRINT"NUMBER OF WORDS IN A GIVEN WORD PRO"
130 PRINT"TEXT, SKIPPING WORD PRO COMMANDS.":PRINT
140 PRINT"----------------------------------------":PRINT
150 INPUT"FILENAME   *■■■■";F$: F$=LEFT$(F$,16)
160 INPUT"DRIVE 0 OR 1    0■■■■";DR$
170 IF DR$<>"0" AND DR$<>"1" THEN 160
180 INPUT"MIN # LETTERS/WORD    1■■■■";M$: M=VAL(M$)
190 IF M<1 THEN 180
200 OPEN 15,8,15: W=0: L=0: M=M-1: PRINT
210 OPEN 8,8,8,DR$+":"+F$+",P,R" : INPUT#15,EN
220 IF EN>0 THEN PRINT"FILE NOT FOUND!": GOTO 470
230 PRINT"OK, READING FILE...":PRINT
240 GET#8,C$,C$ :REM SKIP 2 BYTES
250 GOTO 280
260 REM READ FILE BYTE-BY-BYTE
270 L=L+1
280 GET#8,C$: IF ST<>0 THEN 430
290 C=ASC(C$): IF C=122 THEN 390
300 REM CHK CHAR
310 IF (C>0 AND C<27) THEN 270
320 IF (C>65 AND C<91) THEN 270
330 IF (C>47 AND C<58) THEN 270
340 IF C<>32 AND C<>96 AND C<>31 THEN 280
350 REM END OF WORD
360 IF L>M THEN W=W+1
370 L=0: GOTO 280
380 REM WP CTL LINE
390 GET#8,C$: IF ST<>0 THEN 430
400 C=ASC(C$): IF C<>31 THEN 390
410 GOTO 280
420 REM END OR ERROR
430 IF ST<>64 THEN 450
440 PRINT W;"WORDS": PRINT:PRINT"( WITH";M+1;"OR MORE CHARACTERS )": GOTO 470
450 INPUT#15,EN,EM$,ET,ES
460 PRINT"DISK ERROR": PRINT EN,EM$: PRINT ET,ES
470 CLOSE 8: CLOSE 15: PRINT
```

Program listing. Word Counter.

MICRO QUIZ

What Does This Program Do?

What number is printed when the following program is executed?

```
READ N, R
S = 1
FOR I = 1 TO N
  S = S*I
NEXT I
FOR J = 1 TO R
  S = S/J
NEXT J
FOR K = 1 TO (N-R)
  S = S/K
NEXT K
PRINT S
DATA 13,9
```

(answer on page 147)

CRT CONTROLLER



This intelligent CRT Controller uses an 8085A CPU & an 8275 Integrated CRT Controller. it features:

- 25 lines (80 char./line)
- 5x7 dot matrix
- Upper & lower case
- Two 2716's (controller & char. generator)
- Serial interface RS232 & TTL
- Baud rates of 110, 150, 300, 600, 1200, 2400, 4800 and 9600
- Keyboard scanning system
- Unencoded keyboard required
- Uses + 5V & ± 12V Power Supplies
- Does not have graphic capabilities.

Documentation includes program listing and composite video circuit.

Bare Board only (with doc)	**$39.95**
2716 Char. Gen. A 7	**$19.95**
2716 Program A 12	**$19.95**

A-D CONVERTER



JBEs 16 channel A-D Converter plugs into your Apple II computer. It uses an ADC0817 which incorporates a 16 channel multiplexer and an 8 bit A-D Converter. The 16 inputs are high impedance and the voltage range is 0 to 5.12 volts. Conversion time is <100 μsec. The resolution is 8 bits or 256 steps, linearity is ± 1/2 step. Two 16 pin DIP sockets are used for input, GND & reference voltage connections. There are 3 single bit TTL inputs. Doc. Includes sample program.

81-132A Assm.	**$89.95**
81-132K Kit	**$69.95**
81-132B Bare Board	**$29.95**

EPROM PROGRAMMER



JBE's EPROM Programmer is designed to program 5V 2516's, 2532's & 2716's. It interfaces to the JBE Parallel I/O card using four ribbon cables. An LED indicates when the EPROM is being programmed. A textool zero insertion force socket is used for the EPROM. Comes with complete documentation for writing and reading EPROM's in the Apple II or Apple II Plus. Cables available separately.

80-244A Assm.	**$49.95**
80-244K Kit	**$39.95**
80-244B Bare Board	**$24.95**

PARTS

6502 MPU	**$9.95**
6522 VIA	**$9.95**
Z-80 MPU	**$9.95**
Z-80 PIO	**$9.95**
TWO 2114 RAM	**$9.95**
2716	**$14.95**
50 pin conn.	**$5.95**
Dip Jumper 2 ft.	**$4.95**

6522 APPLE II INTERFACE



The JBE 6522 Parallel Interface for the Apple II Computer, plugs directly into any slot 1 through 7 in the Apple. This card has 2 6522 VIA's that provide:

- Four 8 bit bi-directional I/O ports
- Four 16 bit programmable timer/counters
- Serial shift registers
- Handshaking

A 74LS05 is for timing. Four 16 pin sockets provide easy connections to other peripheral devices. (Dip jumpers with ribbon cables are also available from JBE) The 6522 Parallel I/O card interfaces to the JBE EPROM programmer. Understanding of machine language required to use this board. Inputs and outputs are TTL compatible.

79-295A	**$69.95** Assembled
79-295K	**$59.95** Kit
79-295B	**$19.95** Bareboard

SPEECH SYNTHESIZERS



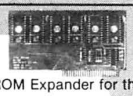
JBEs Speech Synthesizers use the Votrax SC-01 Phoneme Synthesizer chip. The SC-01 phonetically synthesizes continuous speech of unlimited vocabulary. The SC-01 contains 64 different phonemes and 4 levels of inflection accessed by an 8 bit code. It requires 10 Bytes per second for continuous speech. Both boards have an audio amp for direct connection to an 8 ohm speaker.

Documentation includes basic user programs, a phoneme chart and listing of coded words to help you get started. Documentation for the Apple II® Speech Synthesizer includes a disk with many user programs.

81-088 Apple II Speech Synthesizer	**$139.95**
81-120 Parallel Input Speech Synthesizer	**$149.95**

Prices include the SC-01 Chip
SC-01 sold separately for **$ 75.95**

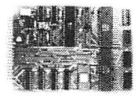
EPROM EXPANSION CARD



JBE EPROM Expander for the Apple II holds six 5V 2716s for a total of 12K bytes of EPROM. This board takes the place of the on board ROM in the Apple. It is software switchable by the same technique used by the Apple II firmware card. Solder jumpers are for reset to the Apple ROM or EPROM Expansion Card. Use JBE EPROM Programmer and Parallel I/O to program your EPROMs. EPROMs sold separately.

81-085A Assm.	**$59.95**
81-085K Kit	**$49.95**
81-085B Bare Board	**$39.95**

81-260 "SLIM"



Single board large scale Integration Microcomputer. This 4.5 x 6.5 board uses the 6502 Microprocessor, two 6522 VIA's, four 2114 RAM's, 2516, 2716 or 2532 EPROM. The fully buffered 22/44 pin bus is similar to the KIM®, SYM®, and AIM® expansion connector. The four 8 bit I/O ports connect through 16 pin dip sockets. This board was designed for control and is ideal for Personal and OEM use.

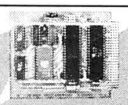
- 6502 MPU
- Two 6522 VIA's
- Four 2114 RAM's (2K bytes)
- One EPROM 2516 or 2532
- Crystal clock 1 Mhz
- Requires 5V 1AMP Power
- 4.5 x 6.5 card
- Power on reset
- Fully buffered-expandable
- Solder mask-both sides

Use your Apple II Computer, JBE 6522 Parallel Interface card and EPROM Programmer as a development system for SLIM.

Prices:

81-260A	**$199.95** Assembled
81-260K	**$149.95** Kit
81-260B	**$ 39.95** Bare Board

6502 MICROCOMPUTER

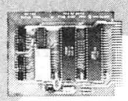


6502 MPU, 6522 VIA, 2716 EPROM, 2114 RAM single board computer. Single 5 volt power supply at 400 Ma. Two independent 8 bit I/O ports with handshake lines. RC controlled 1 Mhz clock.

Complete documentation. I/O lines use 50 pin edge connector. Data and address lines are not accessible. Mod. for 2532 is included. EPROM is not included. 1K RAM, 2K EPROM, 2 I/O ports.

80-153 Assm.	**$110.95**
80-153 Kit	**$ 89.95**
80-153 Bare Board	**$ 19.95**

Z-80 MICROCOMUTER

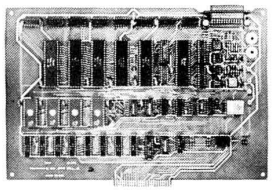


Z-80 MPU, Z-80 PIO, 2716 EPROM, 2114 RAM single board computer. Single 5 volt power supply at 300 Ma. Two independent 8 bit I/O ports with handshake lines. RC controlled 2Mhz clock.

Complete documentation. I/O lines use 50 pin edge connector. Data and address lines are not accessible. Mod. for 2532 is included. EPROM is not included. 1K RAM, 2K EPROM, 2 I/O ports.

80-280 Assm.	**$129.95**
80-280 Kit	**$119.95**
80-280 Bare Board	**$ 19.95**

JBE I MICROCOMPUTER



JBE's 7.75 x 11.75 6502 base Microcomputer has the capacity for 16K of EPROM, 4K of RAM, 8 Parallel Ports and 1 Serial Port. Monitor and Tiny Basic are also available. The fully populated version includes:

- 1 6502 CPU
- 4 6522 VIA (8 Parallel I/O Ports)
- 1 AY5-1013 (Serial I/O Ports)
- 8 2114 RAM (4K)
- 2 2716 EPROM (Monitor & Tiny Basic)

The partially populated version includes:

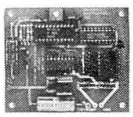
- 1 6502 CPU
- 1 6522 VIA (2 Parallel I/O Ports)
- 1 AY5-1013 (Serial I/O Port)
- 2 2114 RAM (1K)
- 1 2716 EPROM (with Monitor)

Both versions include sockets for 2716s or 2532s, 8 16 pin sockets for I/O interfacing and a DB25 connector for RS232.

All address and data lines are brought off the board to the 50 pin edge connector. (similar to the Apple II bus)

This board also features power on reset and cassette interface.

81-030 C Fully Populated	**$349.95**
81-030M Partially Populated	**$249.95**
81-030B Bare Board	**$ 89.95**
2716 EPROM (with Monitor)	**$ 19.95**
2715 EPROM (with Tiny Basic	**$ 19.95**



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By Frank J. Derfler, Jr.

Communicating With Heavyweights

IBM, Osborne Flex Terminal Muscles

Dial-up Directory is a monthly column devoted to the use of microcomputers as data communications devices. This month, we're going to catch up on what's new with two of the most popular data communications programs on the market. Then we'll look at the communications capabilities of two hot-selling microcomputers: the IBM PC and the Osborne 1. Finally, I'll discuss a useful Basic program that turns your microcomputer into a remote banking device. But first, let me thank those of you who have bought my book, *Microcomputer Data Communications Systems* (some 3500 of you between December and February). The positive comments have been gratifying. Now, let's see what some other people have been writing.

Upgrades of Crosstalk and Omniterm

The good programs just keep getting better! Both Les Freed and David Lindbergh have been busy improving their respective programs, Crosstalk and Omniterm. Les Freed, at Microstuf, Inc., has released a new version of Crosstalk that has some nice features. Crosstalk is a smart terminal program for computers operating under CP/M that provides full file transfer ability and includes an error detection and retransmission file transfer program for error-free transmission of very large data files.

The new Crosstalk version 2.0 lets you toggle the printer off and on, to send up to four prestored strings of up to 50 characters, to open and close the capture buffer and to read the capture buffer on the screen, all while remaining in the on-line mode. These are significant improvements to the program! Crosstalk still permits capture and transmission of data files that are larger than the available RAM.

Les has also improved the documentation and the help commands. The documentation now includes a 51-page manual with several helpful appendices. The programmed help commands are available from an overlay file (in the fashion of WordStar), which reduces the size of the program while increasing the help capability available.

The serial version of Crosstalk has special features for use with the Hayes Stack Smartmodem—it will automatically dial the phone and offer to redial a number if connection is not established; the telephone numbers and other parameters for frequently-called systems can be stored in command files that let you tailor the program to the system you are communicating with; and the program permits auto-answer operation with the Smartmodem.

> I like the quality of engineering of the IBM PC– it looks and feels right. There is no television interference, even on fringe channels.

Crosstalk runs under Digital Research's CP/M operating system. It is now available for the IBM PC running under IBM PC DOS (see below). Les can supply the program in a large number of disk formats including Apple II+ CP/M and Osborne 1. Crosstalk owners can update their program by mailing the original disk back to Microstuf along with $20 for copying. Contact Microstuf, Inc., at their new address, 1900 Leland Drive, Suite 12, Marietta, GA 30067. 409-952-0267.

Omniterm

I don't know of anyone who does a better job of writing an operating manual than David Lindbergh. The latest release of Omniterm (version 1.52) comes with a 21-page manual that supplements David's already superb 75-page manual. David could have a good career writing novels if he ever gets tired of doing software.

Omniterm is a smart terminal program for the TRS-80 Model I or III that I've discussed several times in this column. It offers a great deal of processing power in a user-friendly format. The changes to Omniterm version 1.52 are subtle, but important. This version of the program will run with any DOS for the TRS-80 Model I/III including TRSDOS 1.3 on the Model III, NEWDOS 80, LDOS and all the others. A command has been added that lets the user view the disk I/O buffer in the same way that the receive buffer can be examined, allowing examination of the text before it is saved on disk. Previously, the received text could be reviewed only as it passed through a special review buffer.

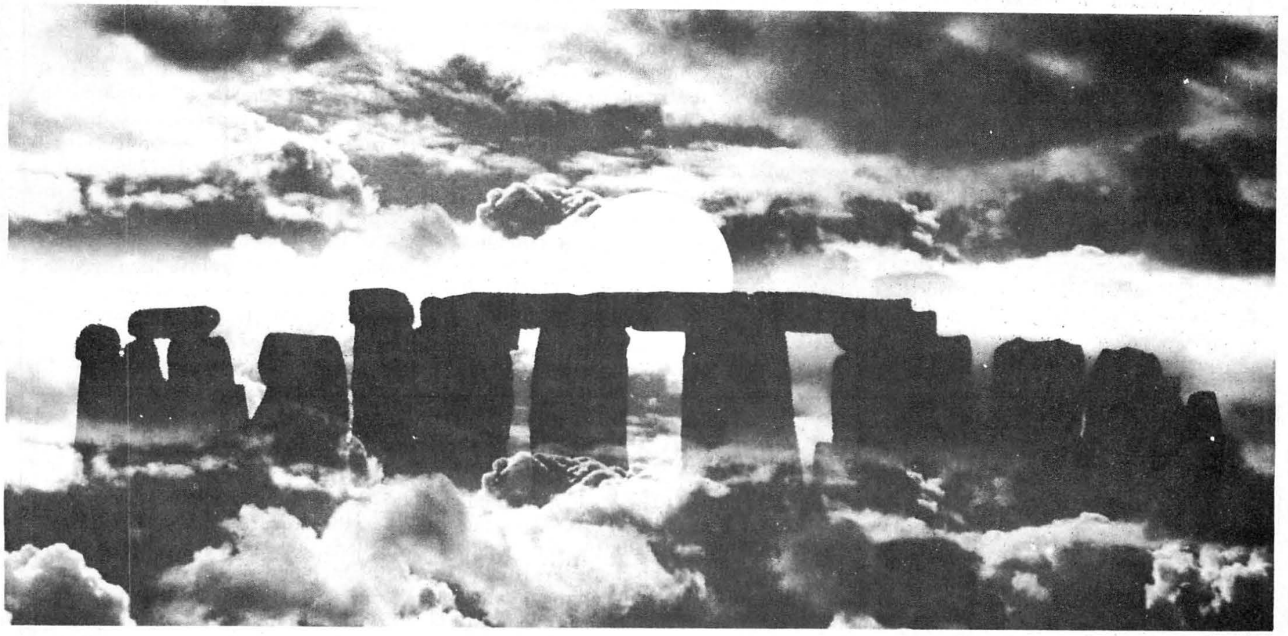
A new display has been added to the command menu that shows the status of the RS-232C handshaking lines. This is valuable if you are troubleshooting the interface to a modem. Another major change in Omniterm version 1.51 and above is the ability to menu-select either the normal port address for the Radio Shack RS-232C serial card or the special port address of the Microconnection. This makes it easier to use a Microconnection modem.

Present owners of Omniterm could benefit from the updates David has made in his program. Lindbergh Systems will upgrade the original disk for $15. Note their new address: 41 Fairhill Road, Holden, MA 01520. 617-852-0233.

Me and My PC

I have an IBM PC and I'm very impressed! I will describe the communications abilities of the system, but first let me tell you some of the things I like and don't like. I like the quality of the

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engineering—it looks and feels right. There is no television interference from the IBM, even on fringe channels. The only computer I have tested that is as free from rfi is the Atari 800. The accessory boards lock in securely and are well designed. The detached keyboard is a pleasure to use, but it would be even better if the enter/return key was bigger. The disk drive capacity is OK at 160K bytes, but the first thing I did was to ship my system off to Apparat in Denver to have double-sided drives installed.

The IBM DOS seems very familiar to CP/M users. Operators who are used to friendlier operating systems (TRSDOS for the Model III, NEWDOS 80, North Star DOS, etc.) may find it Spartan. IBM will certainly get a lot of comments on the file directory: Remember the old-style operating systems that let files scroll off the screen when you called for a directory? Well you had better read quickly if you want to see the listing of the first files on a crowded IBM DOS disk. I simply can't understand why Microsoft (who customized the DOS for IBM) didn't go to school on that one.

The color graphics available from the optional graphics card are a joy to use. IBM Basic makes good use of the keyboard's programmable keys and provides some powerful graphics commands.

Now for communications: The RS-232C serial board is optional on the PC. The IBM standard asynchronous adapter card occupies one of the five available expansion slots, but many companies are rushing combo cards to the market that will load at least three capabilities together. Apparat puts a parallel port, serial port and clock together on one board, and other companies are not far behind. I've suggested to several manufacturers that the PC is a natural for a bus-decoding modem such as the Hayes, Lynx or Microconnection. I haven't heard of one yet, but I believe it is only a matter of (a short) time until an integrated modem appears.

The IBM system disk comes with a dumb terminal program written in Basic. It's a good program, as free dumb terminal programs go. It has an easy-to-use

Pay-by-Micro Banking

By David R. Posh

Communication to Modem: RS-232 Serial Interface

My Vector Graphic system uses an 8251 USART chip to provide the RS-232 serial interface. Only two small routines in the program deal with this chip and they can be easily modified for another type of chip such as the 8250 UART. I have used Basic's Out and Inp () commands to communicate with the modem, avoiding any requirements, restrictions or translations imposed by Open or Print# commands.

Lines 1130–1180 initialize the USART. The first three Outs clear out any garbage that may be left in the chip's buffers and brings it to a known state. The Out of &H40 does a reset and specifies that the next byte sent is mode information. The Out of &H4F sets up asynchronous mode, eight data bits, one stop bit and 300 baud (the baud rate is relative to the clock frequency provided to the chip and may vary between systems). The Out of &H27 resets the USART's error status and turns on RTS and DTR.

Lines 2540–2610 are a subroutine to transmit the charcters in BUFFER$. The Inp on line 2570 reads the USART status into M. Line 2580 checks to see if the USART is ready to receive another character and, if so, transmits the next character.

No input routines are needed since no ASCII data is being received and the Smartmodem has been initialized to not echo characters or return result codes.

Communication to Modem: Smartmodem Local Commands

All commands to the Smartmodem begin with AT. The modem is initialized in lines 1200–1210. Following the AT in BUFFER$, the commands are EO (don't echo characters back to the computer), M2 (keep the monitor speaker on all the time), T (dial using Touch-Tones) and Q1 (don't send response codes back to the computer). All other commands to the Smartmodem use D (dial the following numbers) or H (hang up phone). All dial commands end with a semicolon to keep the Smartmodem in its local command mode (otherwise it would go into a mode waiting for the remote system to raise the carrier and would time out when the bank's computer didn't do this).

Cursor and Screen Control

This program uses cursor addressing to provide faster display of data (no spacing or tabbing from the left of the screen) and to allow the operator to use the cursor arrow keys to move the cursor to the menu selection. When the cursor is moved between selections, the current selection is highlighted in reverse video.

Line 1030 sets up a display width of 255 which inhibits Basic from inserting any carriage returns in the middle of messages. Line 1040 defines a function to generate the codes the Vector Graphic uses for cursor addressing. This line will probably have to be modified for another type of system. The function is set up for two parameters; the first is the line number (0–23) and the second is the column (0–79).

Lines 1050–1060 give names to the codes used to clear screen (CLS$), clear screen from cursor to end-of-screen (CEOP$), toggle reverse video (RV$), and to the characters generated for cursor up (UP$), cursor down (DN$), carriage return (CR$) and

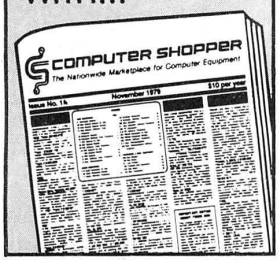
(continued on page 24)

Program listing.

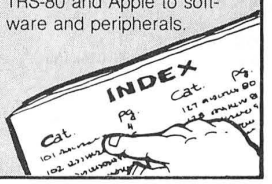
```
1000 ' PAYMASTER TERMINAL SOFTWARE
1010 ' BY POSH SOFTWARE
1020 '
1030 WIDTH 255
1040 DEF FNC$(X,Y)=CHR$(27)+CHR$(128+Y)+CHR$(128+X)
1050 CLS$=CHR$(132):RV$=CHR$(20):RET$=CHR$(13):BKSP$=CHR$(8):CEOP$=CHR$(16)
1060 UP$=CHR$(21):DN$=CHR$(18)
1070 SCMD=5:SDATA=4          ' PORT 5 FOR CMD/STATUS, PORT 4 FOR DATA
1080 '
1090 DIM VENDORNUM$(15),SEL$(15)
1100 ACCT$="D123456789#;"
1110 PIN$=""
1120 '
1130 OUT SCMD,0              ' INITIALIZE USART
1140 OUT SCMD,0
1150 OUT SCMD,0              ' (SEND 0 THREE TIMES TO CLEAR OUT GARBAGE)
1160 OUT SCMD,&H40           ' RESET AND MODE SELECT SUBCOMMAND
1170 OUT SCMD,&H4F           ' SET 300 BAUD ASYNC
1180 OUT SCMD,&H27           ' CLEAR ERRORS AND SET RTS & DTR ON
1190 '
1200 BUFFER$="EOM2TQ1" ' ECHO OFF, SPEAKER ON, TOUCH TONES, NO RESULT CODES
1210 GOSUB 2540              ' INITIALIZE MODEM
1220 PHONENUM$="D1-800-555-5555;"
1230 PRINT CLS$;
1240 GOTO 1430               ' ENTER PASSWORD (PIN), OR SELECT PRACTICE SESSION
1250 '
1260 SEL$(1)="DIAL Paymaster Computer"
```

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Listing continued.

```
1270 SEL$(2)="Transmit Paymaster ACCOUNT Number"
1280 SEL$(3)="Transmit Paymaster PIN Number"
1290 SEL$(4)="Select BILL PAYING Transactions"
1300 SEL$(5)="Select CURRENT BALANCE"
1310 SEL$(6)="Select VERIFYING Whether a Check Has Cleared"
1320 SEL$(7)="HANG UP Phone"
1330 SEL$(8)="Setup Account and Pin Number for PRACTICE Session"
1340 IF PRACTICE=1 THEN SEL$(8)="Setup Account and Pin Number for REAL Session"
1350 SEL$(9)="Return To CP/M"
1360 NUMSEL=9:MENUNAME$="MAIN MENU":GOSUB 2650  ' GET SELECTION
1370 ON SEL GOTO 1530,1630,1700,1770,2190,2260,2410,1430,2480
1380 GOTO 1360
1390 '
1400 ' SETUP FOR PRACTICE OR REAL SESSION
1410 ' ==================================
1420 '
1430 PRINT FNC$(19,16);"Enter PIN Number, or RETURN for practice session";
1440 PRINT FNC$(20,16);"(      )";FNC$(20,17);
1450 MAXDG=4:GOSUB 2910
1460 IF LEN(FLD$)>0 GOTO 1480
1470 PRACTICE=1:ACCT$="D111111111#;":PIN$="D2222#;":GOTO 1260
1480 PRACTICE=0:ACCT$="D123456789#;":PIN$="D"+FLD$+"#;":GOTO 1260
1490 '
1500 ' DIAL PAYMASTER COMPUTER
1510 ' ======================
1520 '
1530 PRINT FNC$(19,16);"Dialing Paymaster Computer";
1540 BUFFER$=PHONENUM$
1550 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1560 FOR X=1 TO 3000:NEXT X      ' DELAY TO KEEP MSG ON SCREEN WHEN DIALING
1580 GOTO 1260
1590 '
1600 ' TRANSMIT PAYMASTER ACCOUNT NUMBER
1610 ' ==================================
1620 '
1630 BUFFER$=ACCT$
1640 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1650 GOTO 1260
1660 '
1670 ' TRANSMIT PAYMASTER PIN NUMBER
1680 ' ============================
1690 '
1700 BUFFER$=PIN$
1710 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1720 GOTO 1260
1730 '
1740 ' SELECT BILL PAYING TRANSACTIONS
1750 ' ==============================
1760 '
1770 BUFFER$="D1#;"
1780 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1790 SEL$(1)="111111 Exxon"                          :VENDORNUM$(1)="111111"
1800 SEL$(2)="222222 Gulf"                           :VENDORNUM$(2)="222222"
1810 SEL$(3)="333333 Citibank MasterCard"            :VENDORNUM$(3)="333333"
1820 SEL$(4)="444444 Sears"                          :VENDORNUM$(4)="444444"
1830 SEL$(5)="555555 Visa"                           :VENDORNUM$(5)="555555"
1840 SEL$(6)="666666 City of Austin (Electric)"      :VENDORNUM$(6)="666666"
1850 SEL$(7)="777777 Southern Union Gas"             :VENDORNUM$(7)="777777"
1860 SEL$(8)="888888 Williamson County MUD (Water)":VENDORNUM$(8)="888888"
1870 SEL$(9)="       NO MORE BILLS TO PAY"           :VENDORNUM$(9)=""
1880 NUMSEL=9:MENUNAME$="BILL PAYING TRANSACTIONS"
1890 GOSUB 2650                  ' ENTER VENDOR SELECTION
1900 BUFFER$="D"+VENDORNUM$(SEL)+"#;"
1910 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1920 IF SEL=9 GOTO 1260
1930 PRINT FNC$(18,16);"Enter AMOUNT (Digits Only, EX: 5000 = Fifty Dollars)";
1940 PRINT FNC$(19,16);"(      )";FNC$(19,17);
1950 MAXDG=5:GOSUB 2910          ' ENTER AMOUNT OF BILL
1960 BUFFER$="D"+FLD$+"#;"
1970 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
1980 PRINT FNC$(20,16);"Enter DATE to Pay (EX: 22 = 22nd of Month)";
1990 PRINT FNC$(21,16);"(   )";FNC$(21,17);
2000 MAXDG=2:GOSUB 2910          ' ENTER DATE TO WRITE CHECK
2010 BUFFER$="D"+FLD$+"#;"
2020 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
2030 PRINT FNC$(22,16);"Ok? (Y or N) ";
2040 D$=INKEY$:IF LEN(D$)=0 GOTO 2040
2050 IF D$="Y" OR D$="y" THEN BUFFER$="D#;":PRINT D$;:GOTO 2080
2060 IF D$="N" OR D$="n" THEN BUFFER$="D*;":PRINT D$;:GOTO 2080
2070 GOTO 2040
2080 D$=INKEY$:IF LEN(D$)=0 GOTO 2080      ' WAIT FOR CARRIAGE RETURN AFTER Y/N
2090 IF D$=RET$ THEN GOSUB 2540:GOTO 1880  ' CARRIAGE RETURN
2100 IF D$=BKSP$ THEN PRINT D$;:GOTO 2040  ' BKSP CAN BE USED TO CHANGE ENTRY
2110 GOTO 2080
2150 '
2160 ' SELECT CURRENT BALANCE
2170 ' ======================
2180 '
2190 BUFFER$="D2#;"
2200 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
2210 GOTO 1260
2220 '
2230 ' SELECT VERIFYING WHETHER A CHECK HAS CLEARED
2240 ' ============================================
2250 '
2260 BUFFER$="D3#;"
2270 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
```

More →

menu, and will operate at 1200 baud. It lets you set transmission parameters or, optionally, use the parameters set in the program for communications with The Source, Dow Jones and IBM series 1 computers. It does not provide for disk file transmission or for capturing received data in a disk file.

The PC has a variable-width screen display mode that's especially useful with systems like CompuServe and Apple Bulletin Boards that transmit short lines—the large text makes reading the screen for a long period of time much less tiring.

Crosstalk gives the PC some nice operating features and makes it into a fine intelligent terminal.

Crosstalk is now available for the IBM PC under the IBM DOS. The serial version of Crosstalk gives the PC some nice operating features and makes it into a fine intelligent terminal.

If you are marketing hardware or software for the IBM PC, let me know. There is a lot of reader interest in this system because of its capability, versatility, and its name.

Osborne 1

Similarly, the system that gives away a pile of software whose retail price almost equals the total price of the package is still creating quite a stir. Does the Osborne 1 communicate? It certainly does, but perhaps not quite the way you would expect. If you have seen an Osborne, you know it has a data port coming out of the front labeled "modem." Unfortunately, it is not a standard RS-232C serial I/O port. This particular port only supplies relatively low Transistor/Transistor Logic (TTL) voltage levels. Obviously, Osborne intended to provide a TTL modem to use on this port, but as of this writing it has not been seen.

Luckily, there is an RS-232C serial port next to the "modem" port and it works well with a standard modem if you have the proper software to address it.

The latest revision to the Osborne has modified the IEEE-488 bus so it will also drive a printer using the Centronics standard parallel printer interface. This is great news to anyone with an MX-80 or one of the other very common parallel printers.

The Osborne's screen display is 54

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characters wide. When wider lines are required, the screen scrolls horizontally to allow a maximum of 128 characters on one line. This screen width is no problem for data communications. All data services will allow the user to enter some kind of formatting directions to adjust the transmitted information to the screen. Because the screen is small, the letters are dense and quite easy to read in the normal operating position. Additionally, devices are now appearing on the market which combine the separate vertical sync, horizontal sync and video signals coming out of the Osborne monitor port into a standard composite video signal that nearly any monitor can use. (The composite video signal isn't pure, so some less-expensive monitors show a tearing or smearing of the screen.) The display is still only 54 characters wide before it scrolls over, but it's bigger.

The communications program recommended by Osborne for use on the Osborne 1 is Micro Link from Wordcraft. Micro Link is a smart terminal program with many good features. It will capture received data and save it to the disk, and it will transmit disk files to a host system using prompted transmission.

Micro Link is flexible, but its flexibility requires the user to read the manual carefully. It's not as easy to use as Crosstalk or Omniterm. For example, Micro Link requires several more commands to transmit a file in the prompted mode than do the other programs. The number of handshaking and formatting options available is impressive, but some

Listing continued.

```
2280 PRINT FNC$(19,16);"Enter CHECK NUMBER or RETURN When Finished";
2290 PRINT FNC$(20,16);"(Only for Checks Since Last Statement)";
2300 PRINT FNC$(21,16);"(      )";FNC$(21,17);
2310 MAXDG=5:GOSUB 2910          ' ENTER CHECK NUMBER
2320 BUFFER$="D"+FLD$+"#;"
2330 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
2340 IF LEN(FLD$)=0 GOTO 1260    ' FINISHED SO GO TO MAIN MENU
2350 PRINT FNC$(19,16);CEOP$;    ' CLEAR BOTTOM OF SCREEN
2360 GOTO 2280
2370 '
2380 ' HANG UP
2390 ' =======
2400 '
2410 BUFFER$="H"
2420 GOSUB 2540                  ' SEND BUFFER TO SMARTMODEM
2430 GOTO 1260
2440 '
2450 ' RETURN TO CP/M
2460 ' ==============
2470 '
2480 PRINT CLS$;
2490 SYSTEM
2500 '
2510 ' SEND BUFFER TO MODEM
2520 ' ====================
2530 '
2540 BUFFER$="AT"+BUFFER$+RET$                  ' ADD "AT" & CARRIAGE RETURN
2550 FOR X=1 TO LEN(BUFFER$)                    ' TRANSMIT EACH
2560    A$=MID$(BUFFER$,X,1)                    ' CHARACTER SEPERATELY
2570    M=INP(SCMD)
2580    IF M AND &H1 THEN OUT SDATA,ASC(A$):GOTO 2600 ' IF READY, TRANSMIT
2590    GOTO 2570
2600 NEXT X                                     ' CONTINUE FOR EACH CHARACTER
2610 RETURN
2620 '
2630 ' MENU DISPLAY
2640 ' ============
2650 PRINT CLS$;
2660 PRINT FNC$(1,31);RV$;"PAYMASTER TERMINAL";RV$;
2670 PRINT FNC$(2,32);"By POSH SOFTWARE";
2680 PRINT FNC$(4,36-INT(LEN(MENUNAME$)/2));"*** ";MENUNAME$;" ***";
2690 PRINT FNC$(5,10);"Select the function you wish to perform by using the 'down-arrow'";
2700 PRINT FNC$(6,10);"and 'up-arrow' keys to place the cursor next to the description";
2710 PRINT FNC$(7,10);"of the function you want to perform.  Then press 'return'.";
2720 FOR X=1 TO NUMSEL
2730    PRINT FNC$(8+X,16);"( ) ";SEL$(X);
2740 NEXT X
2750 SEL=0:PRINT FNC$(8,17);
2760 C$=INKEY$
2770 IF LEN(C$)=0 GOTO 2760
2780 IF C$=RET$ AND SEL>0 THEN RETURN    ' SELECTION MADE
2790 IF C$<>UP$ AND C$<>DN$ GOTO 2760
2800 PRINT FNC$(8+SEL,20);SEL$(SEL);     ' NORMAL VIDEO TO PREVIOUS SELECTION
2810 IF C$=UP$ THEN SEL=SEL-1 ELSE SEL=SEL+1
2820 IF SEL=0 THEN SEL=1                 ' CAN'T SELECT # 0
2830 IF SEL>NUMSEL THEN SEL=NUMSEL       ' CAN'T SELECT BEYOND MAXIMUM AVAIL
2840 PRINT FNC$(8+SEL,20);RV$;SEL$(SEL);RV$; ' REVERSE VIDEO FOR NEW SELECTION
2850 PRINT FNC$(8+SEL,17);               ' PUT CURSOR BACK BETWEEN PARENTHESES
2860 GOTO 2760
2870 '
2880 ' ENTER FIELD
2890 ' ============
2900 '
2910 FLD$="":DG=1
2920 D$=INKEY$:IF LEN(D$)=0 GOTO 2920
2930 IF D$=BKSP$ AND DG>1 THEN DG=DG-1:FLD$=LEFT$(FLD$,DG):PRINT D$;:GOTO 2920
2940 IF DG>MAXDG AND D$<>RET$ GOTO 2920
2950 IF D$=RET$ THEN RETURN
2960 IF D$<"0" OR D$>"9" GOTO 2920       ' ONLY 0-9 ALLOWED
2970 FLD$=FLD$+D$:DG=DG+1
2980 PRINT D$;
2990 GOTO 2920
```

(from page 20)

backspace (BS$).

The INKEY$ function is used for keyboard input so that the program can see each character as it is hit (such as the cursor arrow keys).

Modifications for UART 8250

If your computer uses the 8250 UART rather than the 8251 USART for serial interface, the following information will be helpful.

Rather than communicating through one command/status channel and one data channel, the 8250 uses a bank of eight channels. You will need to know the channel number of the first one; the remaining channels are specified relative to the first. The following assumes that the channel number of the first UART 8250 channel has been stored in the variable PORT.

Initialization:

```
1130 OUT PORT + 1,0          'DISABLE INTERRUPTS
1140 OUT PORT + 3,&H80       'PREPARE TO LOAD BAUD RATE
1145 ' THE NEXT TWO COMMANDS WILL VARY DEPENDING ON THE CLOCK FREQUENCY
1146 ' THIS EXAMPLE IS FOR A HEATH H-89 AT 2 MHZ
1150 OUT PORT + 1,&H01       'HIGH ORDER BYTE OF DIVISOR
1160 OUT PORT,&H80           'LOW ORDER BYTE OF DIVISOR
1170 OUT PORT + 3,&H03       '8 DATA BITS, NO PARITY, 1 STOP BIT
1180 OUT PORT + 4,&H03       'TURN ON DTR & RTS
```

Transmitting routine:

```
2570 M = INP(PORT + 5)
2580 IF M AND &H20 THEN OUT PORT, ASC(A$):
        GOTO 2600
```

Example

Following is an example of a typical bill-paying transaction. The @ character is used to indicate the cursor.

User: Load program, turn on Smartmodem, turn up volume on monitor speaker, make sure modem is connected to phone line.

Display: Enter PIN Number, or RETURN for practice session (@)

(continued on page 26)

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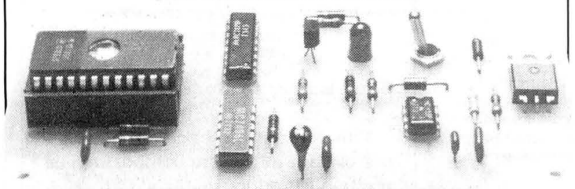
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(from page 24)

User: Enters PIN (password)
Display:

Paymaster Terminal
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Main Menu

Select the function you wish to perform by using the down arrow and up arrow keys to place the cursor next to the description of the function you want to perform. Then press return.

@
( ) DIAL Paymaster Computer
( ) Transmit Paymaster ACCOUNT Number
( ) Transmit Paymaster PIN Number
( ) Select BILL PAYING Transactions
( ) Select CURRENT BALANCE
( ) Select VERIFYING Whether a Check Has Cleared
( ) HANG UP Phone
( ) Setup Account and Pin Number for PRACTICE Session
( ) Return to CP/M

User: Moves cursor down to dial entry and hits return
Speaker: Sound of dial tone, dialing, then computer voice "Welcome to University Savings Paymaster. Please enter account number." followed by a beep to indicate it is ready to receive
User: Moves cursor down to account menu entry and hits return
Speaker: Sound of dialing, then computer voice,"Please enter personal identification number." beep
User: Moves cursor down to pin menu entry and hits return
Speaker: Sound of dialing, then computer voice, "Please enter type of transaction." beep
User: Moves cursor down to bill paying menu entry and hits return
Speaker: Sound of dialing, then computer voice, "Your account balance is xxx dollars and xx cents. Please enter payment instructions." beep
Display:

Paymaster Terminal
by Posh Software
Bill Paying Transaction

Select the function you wish to perform by using the 'down arrow' and 'up arrow' keys to place the cursor next to the description of the function you want to perform. Then press 'return'.

@
( ) 111111 Exxon
( ) 222222 Gulf
( ) 333333 MasterCard
( ) 444444 Sears
( ) 555555 Visa
( ) 666666 Electric
( ) 777777 Gas Company
( ) 888888 Water/sewer bills
( ) NO MORE BILLS TO PAY

User: Moves cursor to Sears menu entry and hits return
Speaker: Sound of dialing, beep
Display: (added below menu selections):
Enter AMOUNT (Digits only, EX: 5000 = Fifty dollars)
(@)
User: Enters 1835 (amount of check) and hits return
Speaker: Sound of dialing, beep
Display: (added below amount entered):
Enter DATE to Pay (EX: 22 = 22nd of Month)
(@)
User: Enters 12 (date to write check) and hits return
Speaker: Sound of dialing, computer voice, "Pay vendor number 444444, amount eighteen dollars and thirty-five cents, on May twelfth. Please verify." beep
Display: (added below date entered):
Ok? (Y or N) @
User: Enters Y and hits return
Speaker: Sound of dialing, computer voice, "Please enter payment instructions." beep
Display: (screen is cleared and original Bill Paying Transactions menu is displayed)
User: Moves cursor to "No More Bills To Pay" menu entry and hits return
Speaker: Sound of dialing, computer voice, "Your one payment totals eighteen dollars and thirty-five cents. Your account balance is xxx dollars and xx cents. Thank you for calling University Savings." click (their computer hangs up)
Display: (screen is cleared and original Main Menu is displayed)
User: Moves cursor to "Hang Up" menu entry and hits return
Speaker: Smartmodem hangs up phone
Dislay: (screen in cleared and original Main Menu is displayed)
User: Moves cursor to "return to CP/M" menu entry and hits return
Display: A>@

Modifications for Different Pay-By-Phone Services

The following documents three subroutines that are used extensively throughout the program. Modifications for a particular bill-paying service would likely involve changing the parameters that are passed to these routines, or adding/deleting GOSUBs to them.

Numeric Field Entry

This subroutine handles the input of any numeric field. As each key is hit, it is verified to be a numeric digit. Backspace key can be used for correction. It returns when the carriage return key has been hit.

Entry: GOSUB 2910
Parameters: Maximum number of digits in MAXDG
Returned: Number in FLDS

Menu Display and Selection

This subroutine displays a menu name, instructions and menu selections on the screen. It returns when the selection has been made.

Entry: GOSUB 2650
Parameters: Menu name in MENUNAME$
Selection descriptions in SELS() array
Number of selections to use in NUMSEL
Returned: Selection number selected in SEL (can be 1 to NUMSEL)

Send Buffer to Modem

This subroutine handles the sending of data to the Smartmodem. The prefix AT is added, along with the suffix of the carriage return code.

Entry: GOSUB 2540
Parameters: Data to transmit in Buffer$
Returned: No parameters returned

of the possible combinations available are seldom seen in common operation.

Micro Link will not perform any kind of file transfer using error detection and retransmission. This is a feature found in many other CP/M programs (although they do not all use the same transfer protocol).

Micro Link does provide a powerful smart terminal capability that can be used in many different situations. The software is reasonably priced at $89.85. See your local Osborne dealer or contact Osborne Computer Corporation at 26500 Corporate Ave., Hayward, CA 94545. 415-887-8080. Crosstalk is also available for the Osborne 1.

Electronic Banking

Many banks and savings institutions provide their customers with the ability to transfer funds and pay bills through a push-button telephone. The bank customer selects certain functions from an electronically spoken menu of options by pushing a button on the phone. Other information, such as account numbers, verification codes, the creditor's reference number and actual money amounts, are entered by the customer using the telephone dial buttons. This is a pleasant convenience, but it requires good record

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keeping and careful attention to detail. Record keeping and detail tending are things a computer does very well.

A computer needs two things to interface with a pay-by-phone banking system: the proper program, and some method of generating the dual-tone multi-frequency signals normally produced by the buttons on the phone. The Hayes Stack Smartmodem provides the needed signaling capability. Dave Posh has provided a Basic program that will do the work. (See program listing.)

Dave Posh is a programmer and consultant from Austin, TX. His program lets the bank customer use a microcomputer as a smart terminal to: 1) check the present balance in the account; 2) verify if a check has cleared; and 3) pay bills. The program is menu driven, and it has options that let you automatically dial the bank, transmit the needed account number and password, select any of the functions listed above, and even practice making payments without actually involving the bank. Dave's program is intended for use with MBasic and it is set to initialize the serial port on a Vector Graphic computer. He includes some information on initializing other serial devices.

This system wouldn't be practical if it weren't for the unique capabilities of the Smartmodem. The Smartmodem doesn't just autodial and send the needed tones—it also has a built-in speaker that allows the bank customer to hear the voice-synthesized responses from the bank's computer.

This system wouldn't be practical if it weren't for the unique capabilities of the Smartmodem.

It's interesting to note the irony of what we are doing with this system. The bank went to a lot of trouble to enable its customers to enter data from any telephone and to receive easily-understood voice synthesis responses. Now we've automated the tone production and probably wish the bank would reply in ASCII. None of this proves anything about the future of voice synthesis, data entry or remote banking, but it does show how different the needs and capabilities of individuals can be.

If you have any technical comments on the program, contact Dave Posh at PO Box 15681, Austin, TX 78761. Dave, thank you for sharing this program with us.

Micro-Courier—Revisited

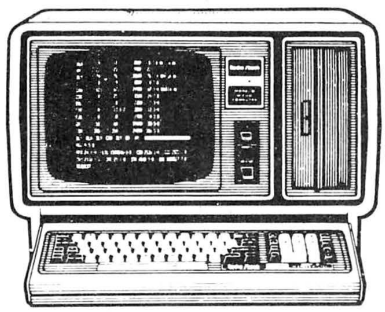
In the March 1982 issue of *Microcomputing* I reviewed a program called Micro-Courier for the Apple II. In the review, I stated that Micro-Courier did not perform error detection and retransmission during file transfer. The producer of the program, Microcom, insists that I am wrong. Gregor Ferguson, Software Product Manager for Microcom, says that Micro-Courier uses both character parity check and block checksum. Ferguson also points out that Micro-Courier will transmit binary files without conversion.

Sorry for missing the check and retransmission capabilities, but three of us worked on the program and none of us were aware of them.

Two-Way Communications

If you have any other different or unique uses for data communications devices, let's share them. Contact me at TCB967 on The Source, 70003,455 on CompuServe, or the AMRAD CBBS 703-734-1387. If you send paper mail, please include a stamped return envelope.□

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By Walter Koetke

Searching For Solutions

Getting There Is Half The Fun

Problem Solving

Although the availability of microcomputers has not changed the basic procedures important when problem solving, the microcomputer can help highlight those procedures. Many students develop the incorrect notion that obtaining an answer is the most important goal. Considering the examples that surround them, this is quite understandable. There are many production environments in which the correct solution is the only goal. The procedures used for obtaining that solution are of little importance as long as the solution is correct. Schools must, however, teach students the techniques of problem solving. While the solution may necessarily be the only goal in many other environments, schools must highlight the procedures for reaching that goal.

This month's column presents some problems that can be used when teaching the techniques of problem solving. None of the problems require any mathematics beyond first-year algebra, and none require specialized knowledge in other fields.

You are the most important part of this column. Neither the problems nor their answers will be of much future value. However, the procedures you develop when solving the problems may often be useful.

When solving a problem you should first be sure that you thoroughly understand the question, then make your plan for obtaining a solution. As you follow your plan toward the solution, keep re-evaluating it. Is the plan working as you intended? Can some of the steps be done more easily another way? Have you really considered all possible cases? Be very persistent. Even if you have the opportunity to see the correct answer before you solve the problem, don't look at it. Remember that the steps used to obtain the answer are far more important than the answer itself, and none of these steps are evident when you look at a simple statement of the solution.

Remember too that you should not be easily discouraged. Steps in the solution of many problems include frustration, errors, floundering and even some guessing. These steps can also include enjoyment and a great deal of satisfaction. The problems in this column are intended to provide you with all of these experiences.

Address correspondence to Walter Koetke, Putnam/Northern Westchester BOCES, Yorktown Heights, NY 10598.

Problem 1

Tell whether the following statement is true or false, and give reasons to demonstrate that your conclusion is correct. Don't just guess; obtain verifiable facts.

"If every person in the world was given a rug measuring 9 feet by 12 feet, all of the rugs could be spread flat on the ground in the state of West Virginia and no rug would touch any other rug."

Problem II

Write a Basic program that will translate entered numbers to their English names. Your program should work for all integers from −1000 through 1000. The output from several runs of your program should appear as:

```
RUN
INPUT VALUE? 67
SIXTY SEVEN
INPUT VALUE? -8
NEGATIVE EIGHT
INPUT VALUE? 18.3
INPUT MUST BE AN INTEGER
INPUT VALUE? -1020
THAT VALUE IS OUT OF RANGE
INPUT VALUE?
```

As students develop a solution to this problem, many are likely to develop an algorithm that can be readily generalized. They will be able to extend the limits to ±1,000,000 with little or no difficulty.

Problem III

Write a Basic program that can be used to simplify expressions of the form $\sqrt{A}\sqrt{B}$, where A and B are any positive integers. The output from several runs of your program might appear as:

```
RUN
A AND B ARE? 5, 7
SIMPLIFIED FORM IS SQR ( 35 )
A AND B ARE? 8, 6
SIMPLIFIED FORM IS 4 *SQR( 3 )
A AND B ARE? 32, 2
SIMPLIFIED FORM IS 8
A AND B ARE?
```

Problem IV

A *palindrome* is a word, sentence,

Listing 1. Expanded version of Graphic Spaceships program that appeared in the October 1981 column. Submitted by Tom Traumann, a ninth grader at Brandywine High School in Wilmington, DE.

```
1 CLS
2 PRINT@15,"LEARNING WITH SPACESHIPS"
3 PRINT @79,"COPYRIGHT - KILOBAUD/MICROCOMPUTING -- OCT 1981"
4 PRINT @143,"FROM 'COMPUTER BLACKBOARD' BY WALTER KOETKE"
5 PRINT @207,"REVISED VERSION BY TOM TRAUMANN"
6 FOR T=1 TO 2000: NEXT T
10 CLS
20 C$=CHR$(170)+CHR$(191)
30 PRINT @991,C$;
31 PRINT @704,"SHOTS"::PRINT @763,"HITS"
32 PRINT @768,"-----"::PRINT @827,"----"
33 PRINT @832,S::PRINT @890,H
35 S$=CHR$(128)+CHR$(128)+CHR$(128)+CHR$(128)+CHR$(140)+CHR$(140)+
   CHR$(143)
36 S$=S$+CHR$(140)+CHR$(140)+CHR$(128)+CHR$(128)+CHR$(128)
40 OVER=64 : DOWN=43
50 FLAG=0 : P=128
60 IF P=191-9 THEN C=-1
70 IF P=128 THEN C=1
```

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number or anything else that reads the same backward as it does forward. The words "level," "radar" and "solos" and the numbers 44, 12321 and 7997 are all palindromes. Students should be familiar with data statements and subscripts before tackling this sequence of problems on palindromes.

A. Write a Basic program that will permit a user to enter *n*, then an *n* digit number. The output of the program should tell whether or not the entered number is a palindrome.

B. Consider the following two examples:

Given 97,

```
   97
  +79
  176
 +671
  847
 +748
 1595
+5951
 7546
+6457
14003
+30041
44044  ←A palindrome after six additions
```

Given 64,

```
   64
  +46
  110
 +011
  121  ←A palindrome after two additions
```

Write a Basic program that will permit a user to enter *n*, and then an *n* digit number. The output of the program should then be the number of additions required (as in the examples) before a palindrome is obtained.

The following two questions are decidedly more challenging than the previous two. You should complete part B before trying these.

C. Which of the integers 1 through 99 requires the greatest number of additions (as in part B) before a palindrome is obtained? How many additions are required for this number, and what is the palindrome that is eventually obtained?

D. Which of the integers 1 through 200 requires the greatest number of additions (as in part B) before a palindrome is obtained?

Problem V

Discussions of the use of random numbers and their applications to simulations have been widely published. Such discussions certainly should be in any mathematics or science text currently being used in secondary school classrooms. The following four problems are suitable when students are being introduced to the ideas of random numbers and simulation. In each case, a student in a first-year probability course should be able to calculate the answers with no computer support—just a calculator for the arithmetic. Obtaining the correct answer is not, however, the primary objective in solving the problems. The primary objective should be learning the techniques of developing accurate simulations.

A. Suppose that three coins are flipped together 500 times. How many times can you expect to obtain three tails?

B. Suppose that two ordinary dice are rolled 200 times. On how many rolls will the two dice show exactly the same number?

C. An elevator in an office building has broken down in an unusual way. When-

Listing 1 continued.

```
80 P=P+3*C
85 PRINT @832,S;:PRINT @890,H;
90 PRINT @P,S$;
100 IF FLAG=1 THEN 140
110 K$=INKEY$
120 IF K$<>" " THEN 60
125 S=S+1
130 FLAG=1
140 RESET(OVER,DOWN)
150 DOWN=DOWN-2
155 IF DOWN=5 AND S=10 THEN 240
160 IF DOWN<0 THEN DOWN=43 : FLAG=0 : GOTO 60
170 IF POINT(OVER,DOWN)=-1 THEN 200
180 SET(OVER,DOWN)
190 GOTO 60
200 CLS
205 H=H+1
210 PRINT @P,"KABOOM!";
225 FOR I=1 TO 50
226 NEXT I
227 GOSUB 1000
228 IF S=10 THEN 240
230 GOTO 10
240 CLS
242 PRINT "H =";H;PRINT "S =";S
244 T1=T1+10: Z1=Z1+H
245 Z=Z1*100/T1
250 PRINT "YOUR AVERAGE IS:",Z
260 PRINT "THE RANKS ARE AS FOLLOWS:"
265 PRINT
270 PRINT "CLASS              # OF POINTS"
275 PRINT "-----              ----------"
280 PRINT "GENERAL    (1)     85 - 100"
290 PRINT "COLONEL    (2)     70 -  84"
300 PRINT "MAJOR      (3)     55 -  69"
310 PRINT "CAPTAIN    (4)     40 -  54"
320 PRINT "CORPORAL   (5)     25 -  39"
330 PRINT "PRIVATE    (6)      0 -  24"
340 PRINT : PRINT
344 FOR I=1 TO 1700 : NEXT I
345 CLS
350 PRINT "YOUR RECORD MAKES YOU WORTHY OF THE FOLLOWING RANK":
351 FOR P=1 TO 500:NEXT P
352 CLS
353 FOR X=1 TO 500:NEXT X
355 PRINT @531,"ISN'T THE SUSPENSE KILLING YOU?"
357 FOR H=1 TO 600:NEXT H
358 CLS
360 IF Z>84 THEN 420
370 IF Z>69 THEN 430
380 IF Z>54 THEN 440
390 IF Z>39 THEN 450
400 IF Z>24 THEN 460
410 GOTO 470
420 PRINT "YOU ARE A GENERAL...CONGRATULATIONS"
425 GOTO 480
430 PRINT "YOU ARE A COLONEL...CONGRATULATIONS"
435 GOTO 480
440 PRINT "YOU ARE A MAJOR...CONGRATULATIONS"
445 GOTO 480
450 PRINT "YOU ARE A CAPTAIN...GOOD LUCK"
455 GOTO 480
460 PRINT "YOU ARE A CORPORAL...GOOD LUCK"
465 GOTO 480
470 PRINT "YOU ARE A PRIVATE...CARRY ON SOLDIER"
471 S=0:H=0
480 INPUT "DO YOU WANT TO PLAY AGAIN (Y OR N) 'ENTER'":C$
481 S=0:H=0
482 IF C$="Y" THEN 10
484 IF C$="N" THEN 486
486 PRINT "BYE"
488 END
1000 CLS
1010 PRINT @27,CHR$(176):PRINT @30,CHR$(140):PRINT @34,CHR$(131):PRINT @38,CHR$(
140):PRINT @41,CHR$(176):PRINT @155,CHR$(131):PRINT @158,CHR$(140):PRINT @162,CH
R$(176):PRINT @166,CHR$(140):PRINT @169,CHR$(131)
1020 FOR O=1 TO 50:NEXT O
1030 CLS
1040 PRINT @18,CHR$(140):PRINT @50,CHR$(140):PRINT @146,CHR$(140):PRINT @178,CHR
$(140):PRINT @216,CHR$(176):PRINT @236,CHR$(176):PRINT @290,CHR$(176)
1050 FOR O=1 TO 50:NEXT O
1060 CLS
1070 PRINT @9,CHR$(131):PRINT @59,CHR$(131):PRINT @201,CHR$(176):PRINT @251,CHR$
(176):PRINT @338,CHR$(176):PRINT @370,CHR$(176):PRINT @418,CHR$(176)
1080 FOR O=1 TO 50:NEXT O
1090 CLS
1100 PRINT @258,CHR$(131):PRINT @319,CHR$(140):PRINT @392,CHR$(140):PRINT @443,C
HR$(140):PRINT @531,CHR$(176):PRINT @561,CHR$(176):PRINT @674,CHR$(131)
1110 FOR O=1 TO 50:NEXT O
1120 CLS
1130 PRINT @449,CHR$(140):PRINT @511,CHR$(140):PRINT @582,CHR$(140):PRINT @637,C
HR$(140):PRINT @784,CHR$(131):PRINT @820,CHR$(131):PRINT @866,CHR$(176)
1140 FOR O=1 TO 50:NEXT O
1150 CLS
1160 RETURN
```

ever the elevator starts it moves exactly one floor, then stops again. To further frustrate the passengers, the elevator is always as likely to move up as it is to move down. Each evening Mr. Rider gets on the elevator at the fifth floor and tries to ride to the first floor. If he does this every day for 200 days, on how many days will he reach the first floor before he reaches the roof on the tenth floor?

D. A rather unusual game is played in the following way. Two coins are tossed together. If both are heads, you win 75 cents. If the coins are different, you win a dime. If, however, both are tails, you lose a dollar. If you play the game 1000 times, how much money should you expect to win/lose?

Problem VI

The topic of prime numbers is rich with challenging problems appropriate for computer solution, but requires little previous background in mathematics. I have addressed both of the following with sixth grade students. The resulting discussions and eventual student-written programs produced many problem-solving strategies as well as mathematical insights. The learning that occurs is a major reason for the importance of making microcomputers available to students.

A. Determine the smallest pair of consecutive prime numbers with a difference of 2, 4, 6, etc. Extend the following table as far as you can.

Difference	Smallest Pair of Consecutive Primes
2	3, 5
4	7, 11
6	23, 29
8	89, 97

B. If N is a prime number, is the number represented by $2N + 1$ also prime? A pair of numbers for which this property is true is called *prime chain*. For example, 2 is prime, and so is 2*(2) + 1, or 5. Thus, 2 and 5 are a prime chain. Of particular interest are prime chains containing more than one pair of numbers. For example, 5 is prime, and so is 2*(5) + 1, or 11. Thus, 2, 5, 11 form a prime chain of three "links." Can you demonstrate that 2, 5, 11, 23, 47 are a prime chain with five links? Determine another prime chain with five or more links.

Problem VII

Sorting algorithms is an appropriate topic in several high school and junior high school classes. Often, however, textbook discussions are very brief, providing no practical application and no discussion of algorithms beyond simple core sorts. The following problems are not especially difficult, yet obtaining their solutions will enhance a student's understanding of the application and difficulties of sorting.

A. Write a Basic program that will read all data in Table 1. Your program should then print two different lists, each containing all of the information in Table 1. The first list should be arranged in descending order of highest elevations; the second in ascending order of total area.

B. Writing programs that sort very long lists of data can become much more complicated than the previous problem. One reason for the increased complication is that all of the data may not fit into the computer's memory at one time. This can occur when one or even several tapes or disks filled with data are to be sorted. The purpose of this problem is to give you a feeling for the type of difficulties encountered when writing larger sorts.

Write a Basic program that will read an array of numbers L(1) through L(100), then print the numbers in ascending order. To simulate the situation of all data not fitting into the computer's memory, your program should be written with the following restrictions:

1. Excluding the variables L(1) through L(100), the program can use a maximum of 60 distinct variables.
2. The variables L(1) through L(100) can only be used as part of LET commands. They should never appear in any other command.
3. Each of the variables L(1) through L(100) can be read or written a total of no more than four times. Every appearance of a variable in the array L in a LET command should be counted as one read or one write for that variable.

The problems suggested in this column offer a broad range of difficulty. I have worked on all of these with students in grades 6 through 12, and all problems were successfully solved by the students. With a teacher's guidance stressing the process of obtaining a solution rather than the answer, each problem can be a valuable learning experience.□

State	Highest Elev. (feet)	Area (sq. miles)
AL	2407	51609
AK	20320	586412
AZ	12633	113909
AR	2753	53104
CA	14494	158693
CO	14443	104247
CT	2380	5009
DE	442	2057
FL	345	58560
GA	4784	58876
HI	13796	6450
ID	12662	83557
IL	1235	56400
IN	1257	36291
IA	1675	56290
KS	4039	82264
KY	4145	40395
LA	535	48523
ME	5268	33215
MD	3360	10577
MA	3491	8257
MI	1980	58216
MN	2301	84068
MS	806	47716
MO	1772	69686
MT	12799	147138
NE	5426	77227
NV	13140	110540
NH	6288	9304
NJ	1803	7836
NM	13161	121666
NY	5344	49576
NC	6684	52586
ND	3506	70665
OH	1550	41222
OK	4973	69919
OR	11235	96981
PA	3213	45333
RI	812	1214
SC	3560	31055
SD	7242	77047
TN	6643	42244
TX	8751	267339
UT	13528	84916
VT	4393	9609
VA	5729	40817
WA	14410	68192
WV	4862	24181
WI	1952	56154
WY	13785	97194

Table 1

LETTERS TO THE EDITOR

Hooked on a Program
Assembling the ZX81
Osborne Defended

```
10  HOME :T = 0
20  VTAB (5): PRINT  TAB( 7);"PUTTING PRACTICE"
30  FOR E = 1 TO 4: PRINT : NEXT E
40  INPUT "HOW MANY PRACTICE GREENS DO YOU WANT?";NU
50  FOR W = 1 TO NU
60  HOME : PRINT "HOLE";W
70 PU = 0
80 X =  INT (60 *  RND (1)) + 1
90  PRINT "TEE IS ";X;" FEET FROM THE HOLE."
100  REM  *THE HIGHER THE NUMBER OF STRENGTH, THE LONGER THE PUTT
110  INPUT "STRENGTH OF PUTT (1-14)?";ST
120 PU = PU + 1
125 T = T + 1
130  IF ST <  = 0 OR ST > 14 THEN  PRINT "BETWEEN 1 AND 14 PLEASE." GOTO 110
140 ST = ST * 4.3
150 X = X - ST
160  IF X <  = .9 AND X >  = .9 THEN  PRINT "RIGHT IN THE HOLE! NICE PUTT!": GOT
O 190
170  IF X <  - 1 THEN X =  ABS (X)
180  IF X >  = 1 OR X <  =  - 1 THEN  PRINT "YOU ARE NOW ";X;" FEET FROM THE CUP
.": GOTO 110
190  IF PU = 1 THEN  PRINT "IT TOOK YOU 1 TRY!": GOTO 210
200  PRINT "IT TOOK YOU ";PU;" TRIES."
210  FOR A = 1 TO 700: NEXT A
220  NEXT W
225  PRINT : PRINT "YOUR TOTAL FOR ";NU;" HOLES WAS ";T;" OR AN AVERAGE OF ";T /
 NU;"."
230  END
```

Listing 1.

Listing 2.

```
10  'Scrazzle
20  '       by
30  '
40  '    E. Stanton Maxey, M.D.
50  '
60  '
70  'See
    Scramble by Edward Rager
    Microcomputing, Jan/1981  pp78-80
80  'See
    Popping and Pushing Permutations
    in BASIC by Kenneth Wasserman
    Microcomputing, Dec/1981  pp50-51
90  '
100 '
110 PRINT"           S C R A Z Z L E":PRINT:PRINT:PRINT
120 PRINT"This program will accept test words"
130 PRINT"of three to seven characters length."
140 PRINT:PRINT"Lower case is first converted to"
150 PRINT"upper case."
160 PRINT:PRINT"The characters are then arranged"
170 PRINT"by ascii value.  Then all possible"
180 PRINT"combinations are printed in order"
190 PRINT"of ascending alphabetical value."
200 PRINT:PRINT"You may select the number of right"
210 PRINT"columns which you wish processed."
220 DEFSTR A
230 DEFINT V,L
240 PRINT:PRINT:PRINT:INPUT"Test word";A
250 PRINT"Number of right hand letters"
```

More

Putting Practice

I am a 13 year old student who attends Friends School in Baltimore and they introduced me to computer science. I immediately took to it. I recently purchased an Apple II computer and I am now becoming a novice programmer. Listing 1 is a sample putting simulation program I made in Applesoft Basic.

Sam Steinbach
Baltimore, MD

Scrazzle

Did you ever get hooked by a couple of lines of Basic which you did not at first clearly understand? It happened to me with Kenneth Wasserman's "Popping and Pushing Permutations in Basic" (Dec. 1981, p. 50).

Does his program work on a MITS machine utilizing CP/M and Basic? Yes, beautifully and without any modifications.

The throughput does produce all possible combinations of letters contained in the input word. Suppose though, that you were looking for certain possibilities, e.g., words beginning with a specific letter. One has to concentrate like crazy to catch the desired words since the throughput comes tumbling forth in seeming total disregard for the ASCII value of the input.

It was apparent to me that this could be easily remedied. Use Basic's LEN function to find the length of the input word and a factorial as follows:

N = 1:FOR V = 1 TO L:N = N + N × (V − 1): NEXT

A DIM S$(N) instruction will then assure the proper space for all possible combinations. Using an appropriate VAL subroutine will save the words generated in alphabetical order; this means repositioning the generated words throughout much of the S$(L) array each time a new word is saved. Anyway, one can now use a FOR/NEXT loop to print out the words and they will properly appear in alphabetical order.

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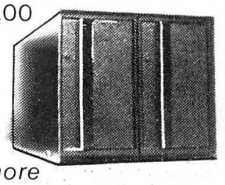
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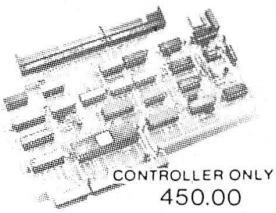
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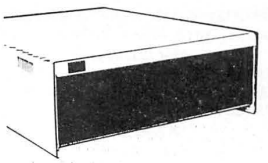


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quired all of the first half of an Oakland Raiders vs Pittsburgh Steelers game and some of the halftime as well to process an input string of only six letters.

Why not generate the output in alphabetical order in the first place? Edward Rager's "Scramble" (Jan. 1981, p.78) could do this if the input words were properly re-ordered before being processed; but this brute force approach was slow.

Scrazzle (see Listing 2) is admittedly something of a microbrute. But it is also modestly elegant. A simple FOR loop (line 160) was developed to handle words of only three letters. The variable string A3 is set equal to the portion of the string which is to be processed. Left$(A,L-3) becomes the portion of the word requiring no processing and is prefixed to the six possible suffixes formed and printed in lines 620–690. Admittedly there is nothing elegant here.

Lines 570–590 are written in exactly the same fashion as lines 610–640 but process one higher order of significance. Actually, line 610 being called as a subroutine allows words of four letters. The algorithm is getting smart.

Lines 530–550, written in exactly the same way, call line 570 as a subroutine. This permits words of five letters. Cute.

Lines 490–510 are of the same logic and call line 530 to give words of six letters. Gorgeous.

Finally, lines 450–470 are written in equivalent fashion to yield words of seven letters. Similar routines can simply be added until words of any desired length are accommodated. The algorithm is both satisfactory and simple.

The remaining portion of the program is rather trivial. Lines 300–320 convert everything to uppercase. Line 260 allows you to process only a selected portion of the input word or, alternately, lines 350–380 will arrange your input word in alphabetical order. Line 400 *then directs* the word to an appropriate subroutine for processing at the proper level.

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Listing 2 continued.

```
260 INPUT"to be manipulated";B
270 PRINT
280 L=LEN(A)
290 '
    Capitals only
300 FOR V=1 TO L:V1=ASC(MID$(A,V,1))
310 IF V1>96 THEN MID$(A,V,1)=CHR$(V1-32)
320 NEXT V
330 IF B<>0 THEN 400 ELSE B=L
340 '
    Sequence characters in ascending order
350 A=A+"z":FOR V=1 TO L
360 A1=MID$(A,V,1):A2=MID$(A,V+1,1)
370 IF A1>A2 THEN MID$(A,V,1)=A2:
    MID$(A,V+1,1)=A1:GOTO 350
380 NEXT V:A=LEFT$(A,L)
390 '
    Start at proper order of significance
400 ON B GOSUB 420,420,620,580,540,500,460
410 IF B<>L THEN 440
420 IF L<3 THEN PRINT"Word too short."
430 IF L>7 THEN PRINT"Word too long."
440 GOTO 240
450 '
    Seventh column significance
460 A7=RIGHT$(A,7):FOR V7=1 TO 7
470 A=LEFT$(A,L-7)+
    MID$(A7,V7,1)+LEFT$(A7,V7-1)+
    RIGHT$(A7,7-V7)
480 GOSUB 500:NEXT V7:RETURN
490 '
    Sixth column significance
500 A6=RIGHT$(A,6):FOR V6=1 TO 6
510 A=LEFT$(A,L-6)+
    MID$(A6,V6,1)+LEFT$(A6,V6-1)+
    RIGHT$(A6,6-V6)
520 GOSUB 540:NEXT V6:RETURN
530 '
    Fifth column significance
540 A5=RIGHT$(A,5):FOR V5=1 TO 5
550 A=LEFT$(A,L-5)+
    MID$(A5,V5,1)+LEFT$(A5,V5-1)+
    RIGHT$(A5,5-V5)
560 GOSUB 580:NEXT V5:RETURN
570 '
    Fourth column significance
580 A4=RIGHT$(A,4):FOR V4=1 TO 4
590 A=LEFT$(A,L-4)+
    MID$(A4,V4,1)+LEFT$(A4,V4-1)+
    RIGHT$(A4,4-V4)
600 GOSUB 620:NEXT V4:RETURN
610 '
    Third column significance
620 A3=RIGHT$(A ,3):FOR V1=1 TO 3
630 A=LEFT$(A,L-3)+
    MID$(A3,V1,1)+LEFT$(A3,V1-1)+
    RIGHT$(A3,3-V1)
640 '
    Second column significance
650 GOSUB 670:NEXT V1:RETURN
660 '
    Printout routine
670 IF POS(0)>38-L THEN PRINT:PRINT
680 PRINT A"  ";
690 IF POS(0)>38-L THEN PRINT:PRINT
700 PRINT LEFT$(A,L-2)+RIGHT$(A,1)+
    MID$(A,L-1,1);
710 PRINT"  ";:RETURN
```


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Editor's Corner

Sweet Sixteen—Micros Come of Age

By Harold Nelson

Microcomputing Technical Editor

New and interesting 16-bit microcomputers seem to be popping up almost every other day. By now most everyone knows that the IBM Personal Computer uses a 16-bit processor. Not too long ago Fortune Systems announced its Fortune 32:16 microcomputer using the Motorola 68000 processor. Altos has released a multiuser 16-bit system using the Intel 8086. Corvus has announced its own intriguing 68000-based micro. We'll be taking a close look at these systems in upcoming months.

With all of the talk about the new 16-bit machines, we thought it was time to take another look at the powerful microprocessors around which these machines are designed. Different processors have different characteristics and capabilities which are reflected in the computer systems employing them. Knowing about the microprocessor used in a computer can be helpful in understanding some of the features of that computer. To help give you a better grasp of the 16-bit micros, we'll compare a few of the more popular processors, namely Motorola's 68000, Intel's 8086, Zilog's Z8000 and Texas Instruments' 9900.

Before comparing some of the features of these processors, we'll look at the general structure of a 16-bit device. No two microprocessors exactly fit the same description. We'll discuss some general concepts that do relate to all 16-bit devices. But keep in mind that designers and manufacturers implement these concepts differently.

The 16-bit Microprocessor

The first and most obvious characteristic of every 16-bit processor is that they can all process "words" consisting of strings of 16 1's and 0's. These 16-bit binary words may be either instructions to be executed, data to be worked on or memory locations to be addressed (actually, some processors use memory location addresses up to 24 bits long). Since instructions and data are usually stored in memory (sometimes peripherals such as disks are also used), the processor has to be able to get instructions and data from memory in order to execute programs. The processors mentioned above can directly address from 64K bytes to 16M bytes —up to 8,388,608 16-bit words of memory.

The processor deals with only one of these memory locations at a time. Each memory location has its own address consisting of a 15- to 24-bit binary number (for the devices being considered). The processor generates the address of the location with which it is to communicate. In order for memory to receive this address, the address lines of the microprocessor are connected directly or indirectly (via external devices) to the memory devices. This connection is called the address bus.

The microprocessor, using the address bus, selects a memory location from which it will read information or to which it will write information. This information is transferred between memory and microprocessor on a 16-line data bus, again connecting the processor to the memory devices (and most peripherals). A 16-bit address bus and a 16-bit data bus are represented in Fig. 1.

The processor also needs to communicate with memory in another way. It must be able to tell memory if it is to send or receive data. In

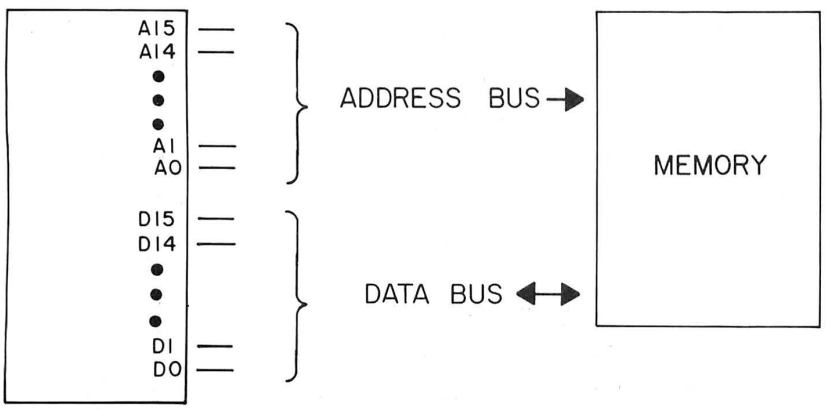


Fig. 1. 16-bit address bus and data bus.

other words, it needs a way to control the flow of information. This control is exercised via a third bus structure, of one or more signals, called a control bus.

All 16-bit processors have internal registers dedicated to performing tasks specified by their designers. Registers within the processor provide temporary storage for instructions, addresses or data to be worked on by the processor. Most microprocessors also have general-purpose registers whose use is under the programmer's control. Use of registers varies greatly among different microprocessors, as we will soon see.

In addition to being able to address great quantities of memory, the 16-bit devices have larger instruction sets than 8-bit processors. This means that a 16-bit processor can perform operations with the execution of a single instruction that would have required a separate subroutine on an eight-bit processor. The arithmetic operations of multiplication and division are typical examples of this 16-bit efficiency.

All of this—longer words, huge amounts of memory, more registers and larger, more complex instruction sets—makes designing systems around 16-bit processors and programming them on a machine-language level a great deal more involved than with eight-bit devices. Of course, working with such systems in high-level languages can be efficient and quite simple.

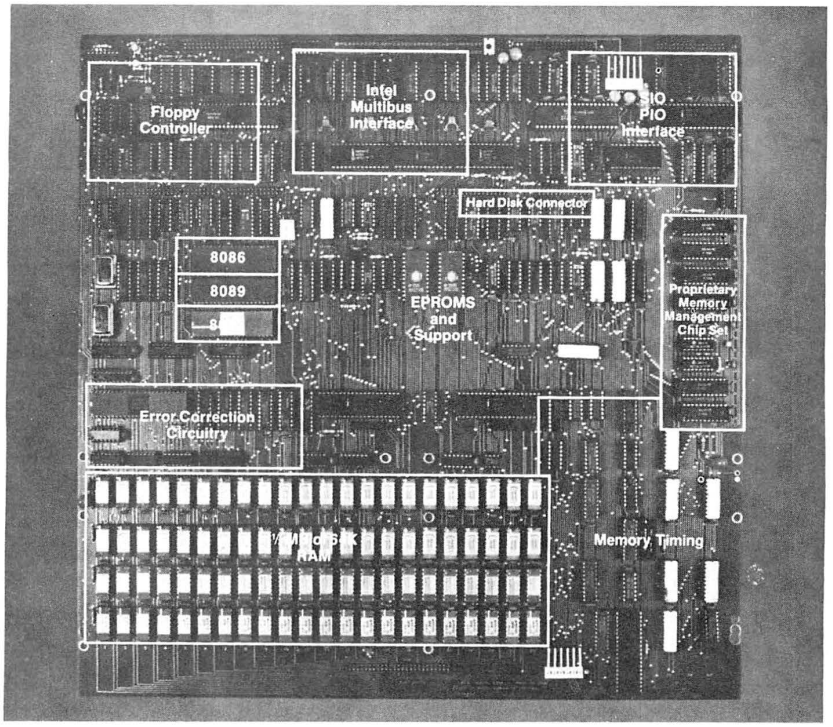
9900

The Texas Instruments 9900 is the oldest of the processors we will consider. TI and others have used the 9900 in a number of small systems including TI's 99/4(A) personal computer.

The 9900 is a 64-pin device. Fifteen of these are memory address lines (a sixteenth bit is used only inside the 9900 to distinguish between byte and word operations), 16 are data lines, with the remainder being power, timing and control signal lines.

The 9900 directly addresses up to 64K bytes or 32K 16-bit words of memory. It has three internal dedicated registers. The processor itself contains no general-purpose registers but uses up to 16 memory locations for this purpose. Any of these 16 registers can hold data or addresses while some can perform specific functions.

The instruction set of the 9900 consists of 72 basic instructions including instructions for data transfer, arithmetic operations, logical operations, transfer of control and I/O. Though this is not a large instruction set as 16-bit processors go (some have around 1000), the 9900 is a powerful and efficient processor.



The Altos ACS8600 is a good example of the powerful system that can be designed around a 16-bit microprocessor—in this case an 8086. It is an eight-user single board computer with ½M bytes of memory onboard. The system can contain nine serial ports, one parallel port, and hard disk or magnetic tape storage as well as floppy disk storage. With Winchester drives total storage can go up to 40M bytes.

Z8000

Actually, there is no Z8000 microprocessor. Zilog and second source, Advanced Micro Devices, market the Z8001 and the Z8002. The Z8002, a 40-pin chip, does not have all of the lines and registers of the 48-pin Z8001. As a result, the Z8002 can address 64K bytes of memory, while the Z8001 can address 8M bytes.

The Z8001's 48 pins contain 16 combined address/data lines, power, control, status and timing lines as well as seven additional address lines, upping the total to 23. This explains why the Z8001 can address so much more memory than the Z8002. With the aid of an external memory management device, the Z8001 can address up to 48M bytes of memory.

Of the Z8001's 23 internal registers, 16 are for general-purpose use. All can handle 16-bit words, some can be divided to contain eight-bit bytes and

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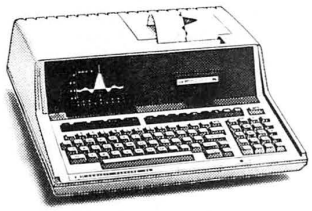
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IBM chose the 8088 for its personal computer.

combinations can handle 32-bit and 64-bit words.

The instruction set of the Z8001 is large and contains a number of instructions to load and transfer data, several arithmetic instructions, logical instructions, instructions for I/O, for bit manipulations, for block transfer, control and control transfer instructions, string and translate instructions and interrupt instructions.

Finally, the Z8001 has the potential to communicate with up to 64K (65,536) eight-bit peripherals or 32K 16-bit peripherals.

8086

Intel's 8086 is a 40-pin device with 20 address lines, 16 of which are combined address/data lines. With a 20-signal address bus, the 8086 can access 1,048,576 memory locations (1M byte).

Of 14 total registers, eight are general purpose. But apparently, these are not as easy to use as the general purpose registers of other processors.

The large instruction set contains data transfer, arithmetic and logic instructions, instructions for control transfer, string manipulations and interrupts and processor control instructions.

This descendant of the 8080 is bound to be—in fact, already is—a very popular microprocessor. CP/M-86 has been designed for it. Also, the 8088, a cousin of the 8086, but with an eight-bit data bus, was the processor chosen by IBM for its personal computer.

We will be looking at these processors more closely in the months ahead.

68000

Like the 9900, the 68000 is contained in a 64-pin package and has separate address lines and data lines. It has a 16-bit data bus and a 24-bit address bus enabling the 68000 to directly address 16M bytes of memory.

While the other 16-bit devices can display eight-bit processor characteristics, the 68000 is a 16-bit processor with characteristics of a 32-bit device. For example, it contains 17 general-purpose 32-bit registers.

The instruction set has data transfer; integer and BCD (binary-coded decimal) arithmetic; and logical, bit manipulation, program control and system control instructions.

The 68000 has asynchronous control lines for 16-bit peripherals using its 16-bit data bus and synchronous control lines for eight-bit peripherals.

We are only starting to see the exciting machines being designed around this interesting processor.

* * *

Corrections

"A Computer/Video Disk Combo That Really Works!" by Anderson and Carr (*Microcomputing*, Jan. 1982, p. 102) contained some misinformation reproduced from the documentation of the Pioneer video disk player. Actually, if you carried out the project exactly as described, you would have no trouble and the system would work as claimed. If, however, like Steve Ciarcia, who discovered the problem, you do not take the IC from the Pioneer remote control unit for use in the PET to Pioneer adapter, you may encounter some difficulties. These will be caused by misinformation contained in Fig. 3 of the article. Steve found that the measurements given there would have been correct for a 42.918 kHz clock, not for a 38 kHz clock as indicated. Also, t2 in the word string (same figure) is listed as a 1 but shown as a 0. The corrected figure and caption, thanks to Steve, are given in Fig. 2. ■

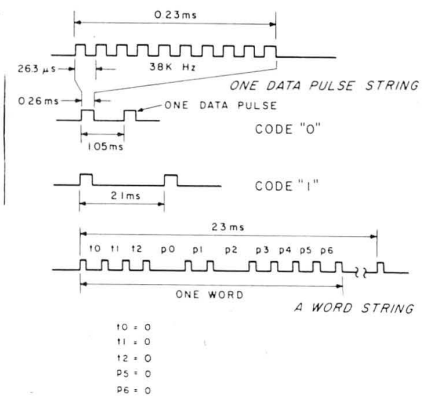
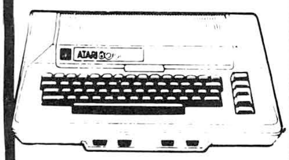


Fig. 2. Pioneer player control signals. One data pulse string is ten cycles of an approximately 38 kHz clock. The coding for a logical 0 is 1.05 ms, a short period between data pulse strings. The logical 1 is twice the logical 0 period, 2.1 ms. The word string delivered to the player is ten bits long; therefore, it consists of 11 actual data pulses. Of the ten bits used, five bits are a fixed code; the remaining five bits can form up to a maximum of 32 commands.

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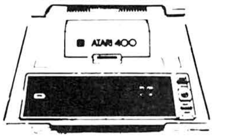


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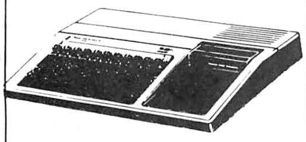


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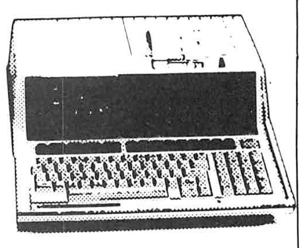
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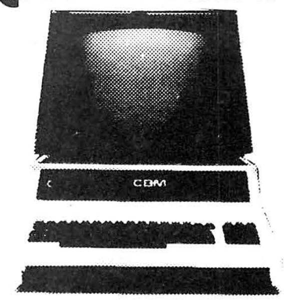
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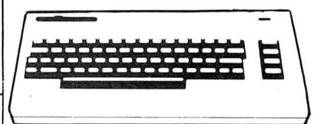
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This author begins a series on what to look for in low-cost printers. The first to take the spotlight is the Centronics 739.

Survival Kit For Printer Buyers (I)

By Jim Hansen

This is the year when we finally get a real choice of under-$1000 printers. In fact, mail-order prices now range from about $300 to $1100 for 80-column printers. Careful shopping will uncover at least one printer in the $1300 range that will take full-width 15-inch paper.

This is the first of a series of reviews of low-cost printers which will explore several popular models from top to bottom. Each review will be written in the same general format so that you can easily compare printers, feature for feature. Each model will be tested under identical conditions to eliminate performance bias brought about by system variations.

I might as well confess now that I'm an engineer at an American printer company. I'm writing these reviews because I'm tired of reading reviews that superficially suggest that each product is the best in its market, that don't really tell you anything you couldn't read in an ad, and that don't increase the reader's computer fluency. I promise to play the game squarely, and hope you're still guessing where I work by the end of the series. If you have to know, send me a stamped, self-addressed postcard and I'll tell you.

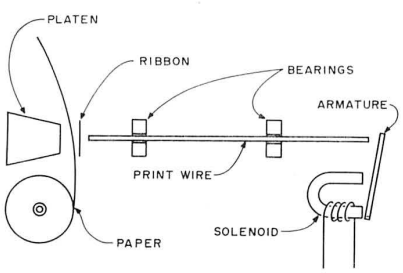


Figure 1. Schematic representation of a typical dot matrix head solenoid, needle, ribbon, paper and platen.

Printers in General

Before I start exploring this month's printer, let's look at the general considerations that go into the design of a low-cost dot matrix printer.

You can split a printer into several general sections. These include paper handling (moving the paper up and down), head motion control (moving the head side to side), head design, ribbon control, the printer control electronics and power supply.

Before you can print a dot on the paper, you must know where the printhead is. If it's at the right place, a dot is printed. The best way to know where the printhead is would be to read the position with some sort of encoder. Low-cost printers can't afford this luxury, so usually one of the following techniques is used.

A synchronous motor can be employed to regulate the speed of the head. If the controller knows when the head left the home position, it can determine where it is, based on the amount of time elapsed since leaving home. This results in a printer that will take the same amount of time to do a carriage return as it does to print a line. Character pitch (the number of characters per inch) is adjusted by changing the needle frequency (the number of times per second a needle is pulsed). The IDS 440/445 printers, now out of production, used this technique.

A stepper motor can be used to move the head. The speed of a stepper is controlled by the rate at which steps are sent to it. Since the controller knows how many steps have been sent, the position of the head is also known. In this case we could consider the stepper to be a sort of synchronous motor, because it will maintain speed synchronous with the step rate as long as nothing jams it. The advantage of this motor is that it can be run at nearly any speed with about the same accuracy to allow the head to be operated at its highest needle frequency. Character pitch is then controlled by changing the speed of the motor, allowing characters of any pitch to be printed at a rate determined solely by the head.

The final method of moving the head in a low-cost printer is that of a dc servo motor. In this case the controller has no way of knowing where the head is after the motor is turned on, so an encoder is required to report the position. Of all the low-cost printers, only the Centronics 739 (and its predecessors) use this technique.

Paper handling in low-cost printers is almost universally done by a stepper motor driving either the platen or paper tractors through a set of plastic gears or timing belt.

Ribbon drives are divided into two camps. Those printers that use reel-to-reel ribbons drive the ribbon with power taken from the head drive system. Examples of this are the Okidata and IDS-440 printers. Those with stuffer-box ribbons (Centronics 739,

Address correspondence to Jim Hansen, PO Box 234, New Boston, NH 03070.

IDS-445 printers and IDS 460) drive the ribbon with a separate motor. Epson drives a stuffer box from the head drive, the only one to do this.

It goes without saying that the simplified mechanics of low-cost printers had to result in complexity elsewhere. The elsewhere is in the printer controller. All low-cost printers use a microprocessor in the controller. In fact, we will see one that uses two. Power supplies are usually the standard linear regulated type, but Centronics uses a switching mode power supply.

Performance of the head determines how fast characters can be printed and how many copies can be made. A lot of physics is involved in head design. Currently low-cost printers use a "ballistic" type head. This means that a print wire is hammered on one end by a solenoid, then free-flies to the ribbon and paper where it impacts. Generally, a spring returns the wire to the home position.

The speed and forces are such that it is a wonder these heads work for more than an hour. In the typical head, the print needles will be struck 600 to 1000 times a second. Each time this happens they accelerate at 100 to 200 g's to a speed of about 100 inches per second. The actual impact with the ribbon and paper is short—on the order of five microseconds. Head design is understood well enough that most heads will now last 50 to 100 million characters.

The bearings that guide the print wires are very important, since they must precisely guide the wire without binding. Unless something destroys a solenoid coil, the usual head failure mode has something to do with the bearings. They must be able to withstand ribbon ink, fibers and paper dust. If these contaminants build up, the wires will sometimes stick, snagging the ribbon and jamming the head. Excessive wear will show up as crooked characters, and can be accelerated by people who discover they can re-ink their own ribbons with stamp pad ink. This kind of ink (and most others on the consumer market) is clay-based, and an excellent abrasive for matrix heads. Matrix ribbons have a special ink to avoid this problem.

Fig. 1 shows a sketch of the relationships of the solenoid, armature, print wires, bearings, ribbon, paper and platen. When the solenoid is energized, a magnetic field builds up, closing the armature which strikes

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the back end of the print wire. Ideally, the magnetic field should build up quickly, saturating the core of the solenoid. As soon as the armature is closed and the print wire is on its way, the field should collapse as soon as possible. After the magnetic field has dissipated, the armature may stick closed. The print wire, on its return flight, is often used to unstick the armature, which must return to its home position before the next dot is printed.

Current flow in each coil of the typical head is heavy—2 to 3 A. Because the head coil is an inductor which resists changes of current flow, high voltage is used to energize the coils in the time allowed. The voltages are usually in the 20 to 60 V range. Overall efficiency is quite low, generally less than 5 percent, which is why heads get hot during operation.

Printer speed is determined solely by the maximum needle rate of the head. Let's say we wanted to print characters five dots wide with a sixth dot for spacing. If the maximum needle rate was 600 pulses a second, we could print 100 characters per second.

At ten characters per inch the carriage would have to move ten inches per second. Carriage return and line feed time cut down the number of characters printed per second, simply because nothing is printed then. If the needle rate were doubled, throughput, or the lines printed per minute, would increase, but not necessarily double, again because of carriage return and line feed overhead.

Bidirectional printing can in some cases help throughput. This is because the printhead does not always have to print from the left margin—it can wait until the following line has been received, then print it from the right margin.

If the printer also has logic seeking, the head seeks to the nearest end of the next line and prints left to right or vice versa as required, further reducing head travel overhead and printer wear.

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Listing 1. Print samples produced on Centronics 739 printer. Notice the difference in the monocase and proportional fonts—especially the lowercase descenders when underscored. At ten characters per inch (ten cpi) monocase the 739 is a standard 80-column printer; at 16.7 cpi it can print 133 columns on an eight-inch page.

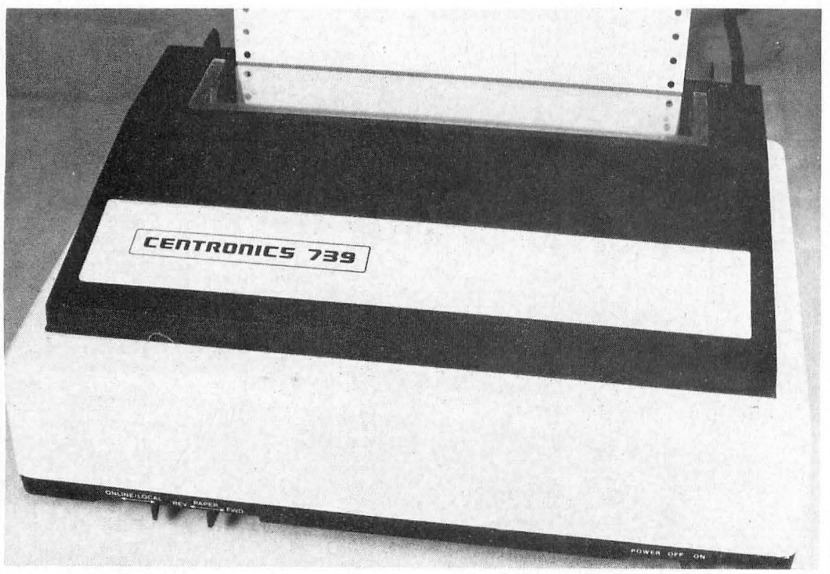


Photo 1. User's view of the Centronics 739 printer. All manual controls are located along the bottom front edge. These include the power, on-line/off-line and paper feed switches. The paper feed moves in single steps with each push of the switch. If the switch is held in either direction, the paper will slew after a short delay.

The Centronics 739

With this overview of printer operation, let's look at the Centronics 739 printer, introduced at last year's NCC.

Externally, it looks much like the previous 730 series of printers. It is small (14½ inches wide by 5 inches high) and weighs about 12 pounds. Inside, all electronics are included on a single printed circuit board. It uses an 8055 microprocessor from either Intel or NEC.

Head positioning is done with a dc motor via a gear train to a plastic rack that rides on top of the main head support shaft. Head position information is provided by a home sensor and a ten pole magnet/hall effect sensor combination. The magnet is turned ten revolutions per inch of head travel, giving head position accurate to 1/100 of an inch. The home sensor is made up of another hall effect device which senses when the head carriage moves a magnet away from it.

The paper feed mechanism is stepper motor/belt driven. This printer is one of the low-cost printers that can take single sheet, roll or fanfold paper. Paper widths of up to 9½ inches (fanfold) can be accommodated. Paper positioning allows both forward and reverse paper motion, providing super- and subscript capability.

The printer can perform a top of form for form lengths of 11½ inches (U.S.) or 12 inches for international models. The form length cannot be programmed or changed by the user.

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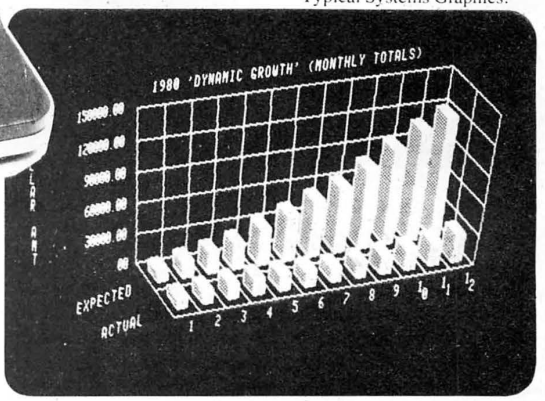
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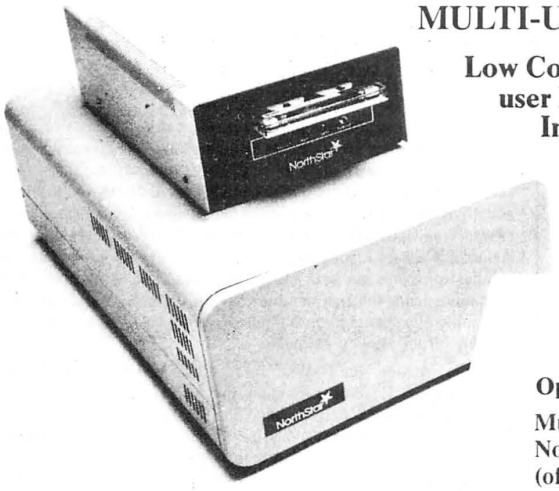
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See List of Advertisers on page 130

The ribbon is driven by a small ac motor and is stored in a stuffer box molded into the top cover. Since a separate cover for the ribbon was not provided, the user must never tip the printer upside down when the printer lid is removed or the ribbon will dump out of the printer and onto the floor. The ribbon is fed with a half twist to form a mobius loop, allowing both sides of it to be used.

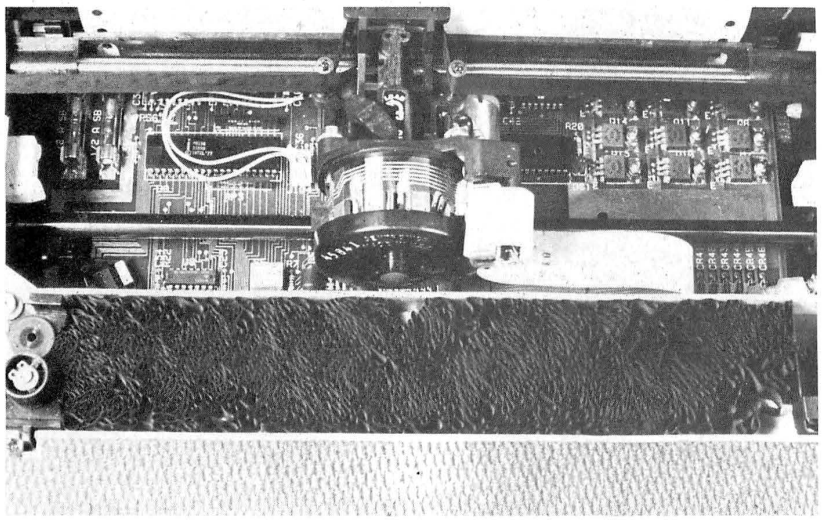


Photo 2. The view of the printer innards with the top cover removed. Shown here from front to back is the acoustic foam along the front edge, the ribbon in the integral stuffer box, the head and head rail and plastic rack, the front head rail and finally the paper. The two fuses visible in the top left corner are for ± 17 volts fed to the interface connector and are not used by the printer. I recommend that they be removed to eliminate possible electrical problems on the interface when ± 17 power is not used there.

Printer Features

Character sets. The Centronics 739 offers character pitches of ten and 16.7 characters per inch, and two unique fonts. (A font is a set of type in one size and face; e.g., gothic, roman or italic. A character set is the list of characters that can be printed.)

One font is used for ten and 16.7 cpi monospaced print, and the other for ten cpi proportionally spaced print. Monospaced print quality is poorer since fewer dots are used to make up the characters, the horizontal dots do not overlap as much and the lowercase descenders only go one dot below the baseline.

The proportional font offers attractive, clear print using overlapping dots. Characters are formed by dots nine high by six to 18 wide, depending on the character. The number of characters printed per inch in this mode varies according to the width of the characters printed, but the character size is about the same as that printed in ten cpi monospaced.

OSI COMPATIBLE HARDWARE

IO-CA10X SERIAL PORT $125
ACIA based RS-232 serial printer port. DIP SWITCH selectable baud rates of 300-9600. Handshaking (CTS) input line is provided to signal the computer when the printer buffer is full. Compatible with OS-65U V1.2 and OS-65D.

IO-CA9 PARALLEL PORT $175
Centronics Standard Parallel printer interface for OSI computers. The card comes complete with 10 ft. of flat ribbon cable. Compatible with OS-65D and OS-65U software.

IO-CA9D DIABLO PARALLEL PORT $175
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IO-LEVEL 3 MULTI-USER EXPANSION $450
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24MEM-CM9...$380 **16MEM-CM9...$300** **8 MEM-CM9...$210**
24K memory card is available at 3 different populated levels. All cards are fully socketed for 24K of memory. The card uses 2114-300ns chips. DIP SWITCH addressing is provided in the form of one 16K block and one 8K block. Also supports DIP SWITCH memory partition addressing for use in multi-user systems.

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Expansion for C1P 600 or 610 boards to the OSI 48 Pin Buss. Uses expansion socket and interface circuitry to expand to 48 Pin Backplane. Requires one slot in backplane.

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Both fonts can be printed double-width (by printing each dot twice) and underlined.

Five foreign-character sets are available. These include French, English, German, Italian and Swedish/Finnish. Up to 12 U.S. ASCII characters are replaced with a European character. The character sets are switch-selected and cannot be changed via software.

Graphics. This printer provides graphics with a dot pattern of 72 dots/inch vertical by 70 horizontal. The dot pattern overlaps so it is possible to print a totally black image. Dot position accuracy is stated to be within one-half of a dot.

The graphics mode is selected by an escape sequence (described later). Graphics characters in this printer are organized starting at CHR$(32) and extend to CHR$(95). Each pass of the printhead covers six rows of graphics dots. Each pin in the head is controlled by a single bit in the graphics characters sent to the printer; the dot to bit mapping is typical of other printers with dot graphics, except that the graphics values here are offset by 32 to allow direct control code operation while in the graphics mode. The printer automatically changes the amount of paper moved during a linefeed to make successive passes of graphics data abut, eliminating the need for a

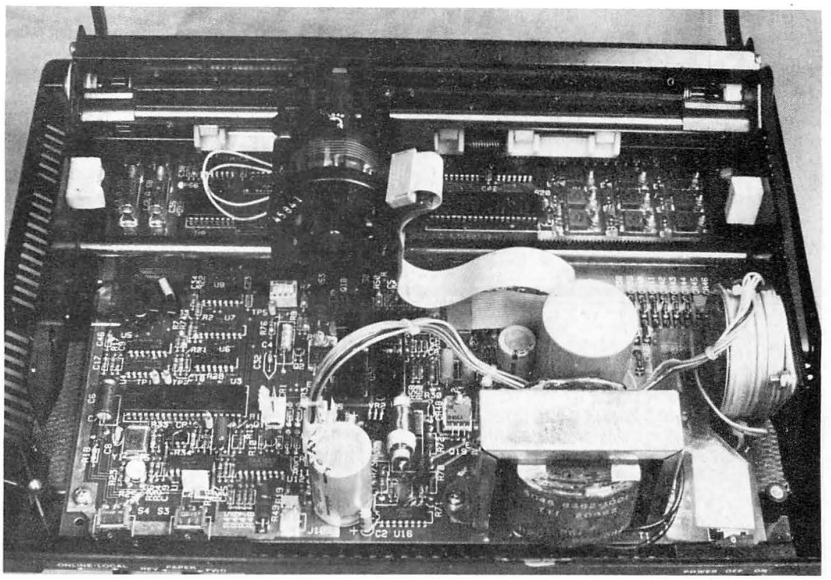
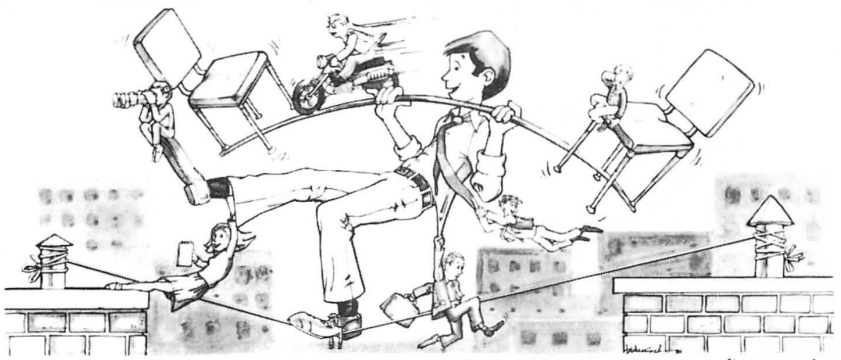


Photo 3. The printer with the entire case removed. The primary fuse, with a plastic cover, is visible to left of the paper feed motor. The printer option DIP switch is located on the left side and below the head as it is positioned in this photograph. The switching power supply inductor that causes the objectionable buzz is visible to the left and slightly above the power transformer. Coating it with GE Bathtub Seal will help quiet it.

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special graphics line feed control character.

Print characteristics. The printer modes are selected by a two or three character escape sequence. For example, to select proportional printing, the printer is sent the string (written in Basic):

```
PRINT CHR$(27);CHR$(17)
```

(CHR$(27) is the escape character, and CHR$(17) is the control character selecting proportional printing.) Graphics mode is selected by a three character sequence:

```
PRINT CHR$(27);"%0";
```

Control codes recognized directly by the printer, regardless of mode, are line feed, carriage return, form feed, start underline (CHR$(17)), stop underline (CHR$(18)) and backspace (CHR$(8)).

Backspace is a special case where a decimal number between 1 and 126 specifying the number of dot positions to be backspaced must be sent after the backspace control code. Forward dot spacing can also be performed, but is controlled with six different escape sequences.

Manual. The manual for this printer consists of 32 pages. It covers operation and user maintenance of the printer in such a manner that it has to be explained in the commentary section of this review.

Tests. I ran the printer with a series of programs to provide print samples and to measure the actual printer throughput. The print samples are given in Listing 1 and the printer throughput is listed in Table 1. I used the printer for about ten hours and found no malfunctions, printer anomalies or failures. Operation was completely predictable based on information found in the manual.

Listing 2. This program was used to produce the print samples shown in Fig. 1 on my TRS-80, Model I. Both listings were printed with the 739.

```
1 REM PROGRAM TO PRODUCE PRINT SAMPLES
10 CLEAR 1000 : REM MAKE SOME ROOM FOR STRINGS
20 REM GENERATE A TEST PATTERN STRING
30 FOR N=33 TO 96
40 A$=A$+CHR$(N)
50 NEXT N
60 FOR N=N TO 127
70 B$=B$+CHR$(N)
80 NEXT N
90 REM A$ WILL PRINT UPPER CASE, B$ WILL PRINT LOWER CASE
100 REM PUT PRINTER IN 10 CPI MONOCASE MODE
110 LPRINT CHR$(27);CHR$(19)
```

More

A Subjective Analysis

This, the final section of my review, is where my personal bias and preferences may cloud reality as seen by others. I can only say that these comments are based on 15 years of experience in the computing field, a period of time sufficient to build up considerable prejudice and

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It does have some limitations. It is memory hungry – 8K is the minimum sized system that can run the Compiler. It also handles only a limited subset of Basic – about 20 keywords including FOR, NEXT, IF THEN, GOSUB, GOTO, RETURN, END, STOP, USR(X), PEEK, POKE, -, =, *, /, , <,> , Variable names A-Z, and Integer Numbers from 0-64K.

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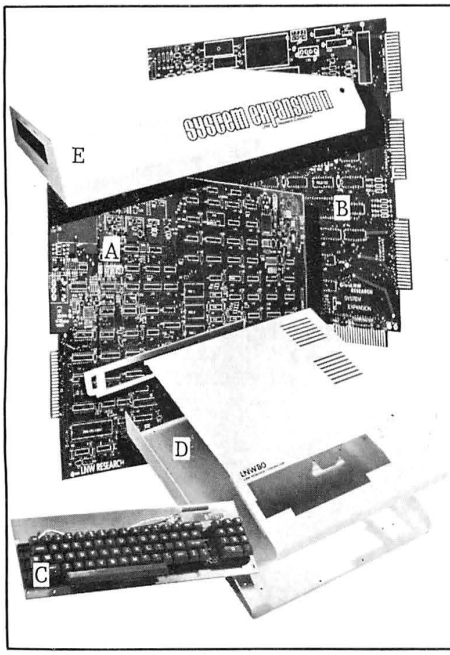
```
120 LPRINT "THIS IS MONOCASE 10 CPI"
130 GOSUB 1000
140 REM PUT PRINTER INTO 10 CPI PROPORTIONAL MODE
150 LPRINT CHR$(27);CHR$(17)
160 LPRINT "THIS IS PROPORTIONAL 10 CPI"
170 GOSUB 1000
180 REM PUT PRINTER INTO 16.7 CPI MONOCASE
190 LPRINT CHR$(27);CHR$(20)
200 LPRINT "THIS IS MONOCASE 16.7 CPI"
210 GOSUB 1000
220 REM NOW PRINT SOME GRAPHICS
230 REM SELECT 10 CPI TO  PRINT MESSAGE
240 LPRINT CHR$(27);CHR$(19)
250 LPRINT "THIS IS A GRAPHICS TEST"
260 LPRINT CHR$(27);CHR$(37);CHR$(48);
270 FOR N=1 TO 5:LPRINT A$+B$:NEXT N
280 REM EXIT GRAPHICS MODE WITH A VALID ESCAPE SEQUENCE
290 LPRINT CHR$(27);CHR$(19)
300 PRINT:PRINT:PRINT:END
1000 REM SUBROUTINE TO PRINT TEST PATTERN
1010 LPRINT A$+B$
1020 REM NOW UNDERSCORE THE TEXT
1030 LPRINT CHR$(15);
1040 LPRINT A$+B$
1050 REM TURN OFF UNDERSCORE
1060 LPRINT CHR$(14);
1070 REM PRINT DOUBLE WIDTH
1080 LPRINT CHR$(27);CHR$(14);
1090 C$=A$+B$
1100 LPRINT CHR$(27);CHR$(14);
1110 LPRINT LEFT$(C$,39)
1115 LPRINT CHR$(27);CHR$(14);
1120 LPRINT MID$(C$,40,39)
1130 LPRINT CHR$(27);CHR$(14);
1140 LPRINT RIGHT$(C$,17)
1150 RETURN
```

onesided judgment. If you think I'm being unfair, unjust or petty, let your voice be heard; the letter column of this magazine is an open forum for complaints.

Assembly, material quality, mechanical design. The 739 is obviously a light-duty machine, but I found that overall the mechanical design is very good. The design is such that assembly, as organized on a production line, must be simple and fairly foolproof. I found no shortcuts in assembly or material quality.

I found the head carriage assembly especially interesting. It is highly tooled, meaning that it is built of a lot of injection-molded parts. The head servo drive system uses a dc toy motor and sounds like a battery-driven electric train when the head is being positioned. (Engineers on the project told me life tests indicate that the motor will outlast the head, but could be destroyed by continuously printing very short lines.) The plastic rack that rides on top of the head support rail is designed to fail if the head is severely jammed. This protects the motor from stall currents and leaves the gear train in one piece; the only

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problem the user will have is buying a replacement.

I did not like the open ribbon storage compartment when I saw it, and less after I dumped the ribbon while positioning the printer for photographs. Users might like to tape a piece of cardboard over the ribbon compartment to prevent this. I understand that a plastic cover to prevent premature ribbon unloading may be furnished with printers manufactured in the near future.

I liked the print quality of this printer. It is among the best in its class. All dots are completely formed and the paper is never smudged. I liked the crisp font designs, but was disappointed to find that they cannot be randomly mixed on a single line. (Printer line control gets messed up if you do this. The manual specifically warns against mixing ten cpi monospaced characters with either proportional or 16.7 cpi characters.)

I was also disappointed that the proportional mode is not usable for straight listings. The end of line must be carefully controlled by the host computer. If a line is too long, the printer will print what it can, then start the next line without regard to word boundaries. (A table of character widths is given in the manual for this purpose.)

Provisions were made for the host to control intercharacter and word spacing to allow justification. (Justification squares off either the left, right or both print margins.) This is done by use of an escape sequence to add dot spaces or the backspace sequence to remove any extra. I found it slightly amusing that there are six different commands to add one to six dot spaces, but only one backspace command to backspace up to 126 dot positions.

I liked the graphics implementation. Many other printers start graphics characters at CHR$(0), which means that control code operation is modified (usually an escape character must be embedded in the graphics text, slightly more complicated to use). The graphics dot pattern is nearly symmetrical—a circle will be squashed by about 2.8 percent. This printer offers medium graphics resolution, but is still far better than current screen dump resolutions.

Manual. The manual is not well organized, but complete and accurate. It is one of the worst features of the printer and is definitely not written with the end user in mind. The first five pages (General Information) gives operating instructions, print samples and the physical characteristics of the printer.

The Installation section (four pages) describes ribbon and paper loading procedures and the only diagram detailing character set selection and self-test operation. The actual self-test instructions (it is a multistep

Feature Summary Table
Centronics 739

Print Characteristics		
Densities (Characters/inch)	10	16.7
Double Width	Y	Y
Proportional	Y	N
Underscore	Y	Y
Justification (Host must perform all control)	Manual	N
Fonts	2	
Character Sets	1 U.S., 5 European; switch selectable, not programmable	
Line Density	6 lines per inch, fixed	
Form Lengths	11½" (U.S.), 12" (European)	
Printer Throughput	36 characters per second (10 cpi, mixed lines)	
Graphics	Dot mapped; 75 dots/inch horizontal, 72 dots/inch vertical	
Mechanical		
Ribbon	12 yard, mobius loop, ½ inch wide	
Paper Types	Single (8½ x 11) sheet, roll or fanfold	
Foot Print (Area required by printer and stack of fanfold paper on operating table)	264 sq. inches (1.83 square feet)	
Power	100 watts	
Size	14½"W x 11"D x 5"H	
Weight	12 pounds	
Interface		
Signaling	Parallel Centronics (only)	
Coding	US ASCII, 7 bit parallel	
Connector	40 pin edge connector; use 3M 3464-0001 or equal	

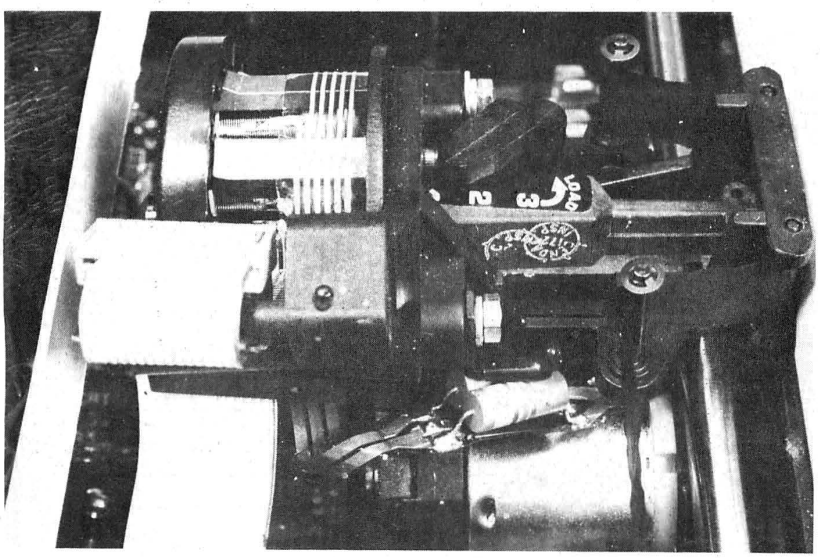
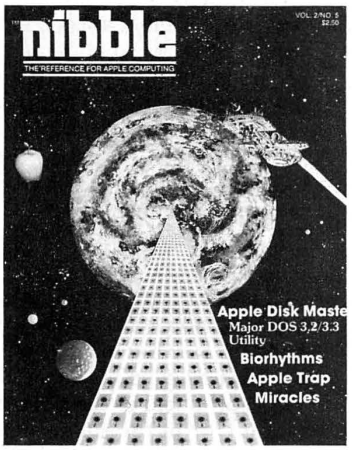


Photo 4. Close-up view of the head assembly showing the paper load lever, head solenoids and drive motor. Of all the low-cost printers, this is the only one to mount the head motor on the carriage. Notice the two noise suppression chokes located just above the dc head motor.

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process involving four DIP switches, the on-line/off-line and power switches) can be found in section five of the manual.

The third section, Interface Information, provides adequate electrical interface information to allow advanced hobbyists to build their own interface cable, but may be difficult for beginners to easily master. A page of character widths used by the proportional spacing font follows the electrical interface page. This section concludes with five pages of information on control code and escape sequence operation, similar to that contained in the first section of the manual.

The Operation section explains how to turn on the printer and provides helpful hints such as using a typewriter pad under the printer to quiet it (it is already fairly quiet) and cautions about dropping objects on the totally exposed controller card when the cover is open.

Section five provides maintenance information. No schematic is included.

Operation. I found the 739 to operate quietly and reliably. No paper jams or ribbon malfunctions occurred during testing. Paper loading is a general pain. I tried all three types of paper (roll, fanfold and single sheet). Universally, they didn't like to start, but once started, fed without incident.

Loading procedure runs something like this:

1. Raise cover, switch printhead to load position. (This moves the printhead back so the nose won't catch on the leading edge of the paper.)
2. Start paper in the slot for roll and fanfold, or in the single sheet feeder door for single sheets. This may include releasing the paper bail, or fumbling around in general, and is where I found the greatest difficulty.
3. After the paper is started and above the printhead, raise the cover again and reset the head to the print position.

It is true that this printer can take single sheet paper, but it is cumbersome to load. I would like to think that perhaps the unit I tested was somehow out of adjustment, but the manual did not list any possible adjustments to try. This is how I found it.

I did not like to find that the interface connector was supplied with ±17 volts. This kind of voltage does not belong on a parallel interface and especially not on an edge connector exposed to the general public. If misconnected, it will blow up your computer interface (and probably the printer as well). I suggest that you remove the two fuses pointed out in Photo 2 unless you are actually using these voltages.

I heard the buzz mentioned in product reviews of the 737 printer. It comes from an inductor in the switching power supply, pointed out in the photographs. If you hear it in the store you probably won't think much of it then. I didn't either for the first 30 minutes of use, but it will

```
10 REM TEST TO DETERMINE PRINT SPEED
15 CLEAR 1000
20 A$="THIS IS A SHORT LINE. "
30 B$="HERE IS A LINE OF MEDIUM LENGTH, 42 CHRS. "
40 C$="THIS LINE IS LONG, A FULL WIDTH LINE (WELL, ALMOST.)  IT IS THE SLOWEST O
NE. "
50 REM
55 REM INPUT FOR OPERATOR DELAY
56 INPUT Z$
60 REM
70 REM  THIS TEST IS FOR SHORT LINE PRINT SPEED - 100 LINES
80 REM
90 FOR N=1 TO 100:LPRINT A$: NEXT N
100 REM
110 REM DELAY FOR OPERATOR
120 INPUT Z$
130 REM
140 REM THIS TEST IS FOR MEDIUM LINE PRINT SPEED - 100 LINES
150 FOR N=1 TO 100:LPRINT B$:NEXT N
160 REM
170 INPUT Z$
180 REM
190 REM THIS TEST IS FOR LONG LINES - 100 LINES
200 REM
210 FOR N=1 TO 100:LPRINT  C$:  NEXT N
220 REM
225 INPUT Z$
230 REM
240 REM THIS TEST IS FOR MIXED LINE LENGTHS
250 REM
260 FOR N=1 TO 33:LPRINT A$:LPRINT B$:LPRINT C$: NEXT N
270 REM
280 REM
285 INPUT Z$
290 REM THIS TEST IS FOR RANDOM LINE LENGTHS
300 FOR N=1 TO 100
310 ON RND(3) GOTO 400,420,440
320 NEXT N
330 END
400 LPRINT A$:GOTO 320
420 LPRINT B$:GOTO 320
440 LPRINT C$:GOTO 320
```

Listing 3. This program was used to run the timing tests. Results are shown in Table 1.

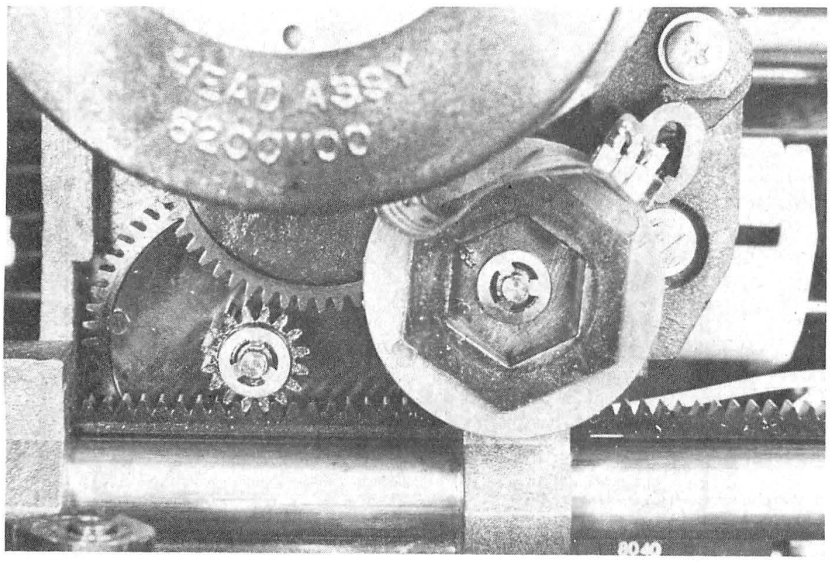


Photo 5. Close-up view of the head assembly. The plastic rack sits loosely on top of the head rail. In the event of a printer malfunction or head jam, it is sacrificed (chewed up) rather than stalling the motor or destroying other gears. The round object with the hexagon in the center is the 10 pole magnet, and at the one o'clock position above it is the hall effect sensor. The magnet spins ten revolutions for each inch of head travel. The hall effect sensor detects each magnet pole as it passes underneath, providing dot placement information to the controller in 1/100s of an inch. This design is unique in low-cost printers.

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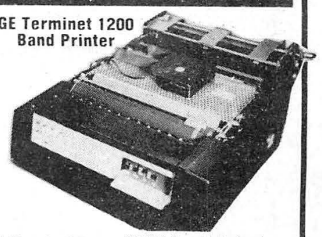
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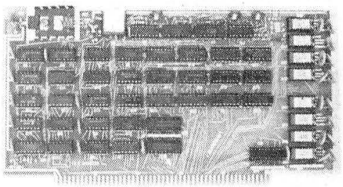
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eventually drive you crazy. There are several solutions: 1) buy an encapsulated version of the inductor from Centronics, which I understand is now being used; 2) if this is not possible you might get some GE bathtub seal or similar product and encapsulate it yourself; or 3) turn off the printer when it is not in use.

Should you buy this product? The printer has a lot of development behind it. It started with the relatively unsuccessful 730, went to the 737 and is now available as the 739. Except for the buzz and difficult paper loading, I have no other operational complaints. It is small, light and output is easy to read as it is being printed.

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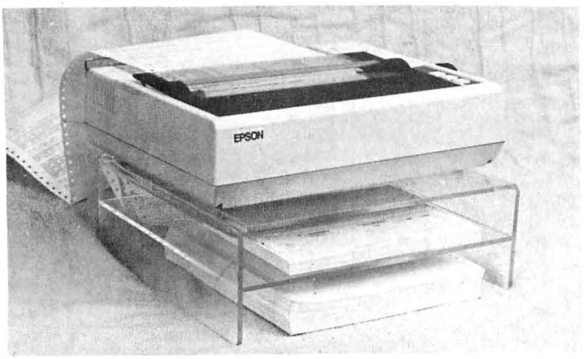
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Table 1. Timing tests—Tests 1, 2 and 3 ran line lengths of 21, 42 and 75 characters respectively. Test 4 ran each of the lines in a fixed order, and Test 5 printed the lines in scrambled order. Printers with logic seeking bidirectional printing should show throughput deviations on the last two tests. The 739 suffered from a relatively slow carriage return flight time and lack of bidirectional print capability. Time were measured with a sweep second hand watch; carriage returns were not counted as characters. The printer was set at 10 characters per inch, monocase for all tests.

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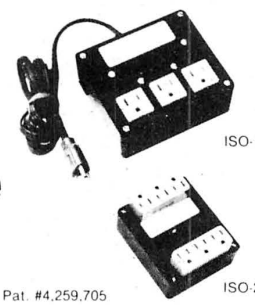
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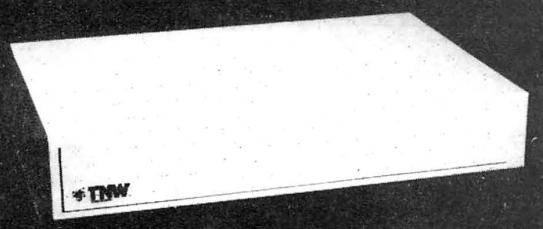
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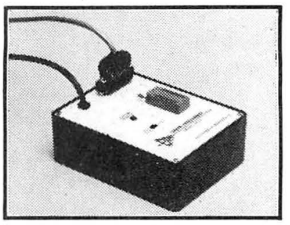
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The H-89 Sounds Off

By Alan E. Hufnagel

The H-89 computer, like many others, has a beeper which sounds when the bell command (ASCII control-G) is given to the terminal section. An internal speaker gives a short tone when something goes wrong or to wake up sleepy operators. While a single tone is acceptable for these purposes, I found that it somehow lacked that certain creativity that we all like to put in our programs. For about two dollars, and a minimum of work, I changed all that and opened up the world of sound for the H-89.

First, let's look at the hardware provided by Heath. Fig. 1 shows the original beeper circuit. This circuit drives the speaker directly from the output of a TTL gate (U416 on Heath schematics). This gate is pulsed by terminal software to produce a square wave output to the speaker. A diode (D402) prevents reverse current flows from the speaker coil from harming the gate's output.

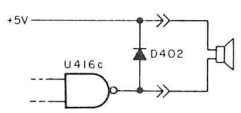


Fig. 1.

Address correspondence to Alan E. Hufnagel, 832 Balfour Road, Montgomery, AL 36117.

Looking on the CPU board, you'll find two unassigned flip-flops (U552), which have their outputs connected to pins 16 and 17 of the expansion connectors (P507, P508, P509). By connecting one of the flip-flops to the speaker and then toggling the output, you'll produce a tone. The faster the flip-flop is toggled, the higher the tone's frequency.

Since I still wanted to be able to sound the original "bell" without any

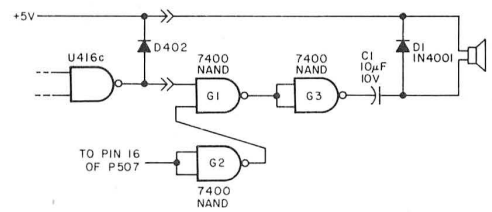


Fig. 2.

```
000   076 020   Start   LD A,020
002   323 362           OUT 362        Turn on Output
004   170               LD A,B         Load delay from B
005   075       Wait1   DEC A          Subtract one
006   000               NOP            Slow
007   000               NOP                 It
010   000               NOP                   Down
011   040 372           JNZ Wait1      Loop if not done
013   257               XOR A          Make A zero
014   323 362           OUT 362        Turn off Output
016   170               LD A,B         Load delay from B
017   075       Wait2   DEC A          Subtract one
020   000               NOP            Slow
021   000               NOP                 It
022   000               NOP                   Down
023   040 372           JNZ Wait2      Loop if not done
025   005               DEC B          Change delay time
026   030 350           JMP Start      Do it again.
```

Siren routine.

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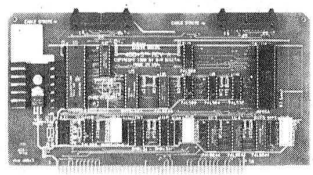
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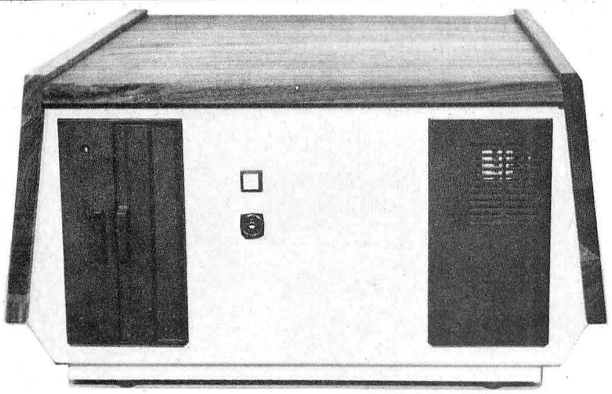
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software modification, the original connection to U416 had to be preserved. Due to the active output characteristics of TTL, I had to avoid simply connecting the two outputs together. An attempt to simply use capacitors to block the dc paths produced strange results—my system reset each time the bell sounded!

I traced this problem back to the other flip-flops in U552, which control the H-89 system. The capacitors allowed the signal from U416 to get into U552 and changed the state of the other flip-flops. I cured this problem by using the circuit shown in Fig. 2.

In this circuit, gate G1 combines the two signals and eliminates the feedback problem. G2 inverts the flip-flop's signal to maintain proper polarity. G3 buffers the output. Capacitor C1 stops a continuous current from flowing should the output remain in a low state. D1 provides protection as in the original circuit.

Your H-89
need no longer
bow its CRT
to those computers
with fancy music routines.

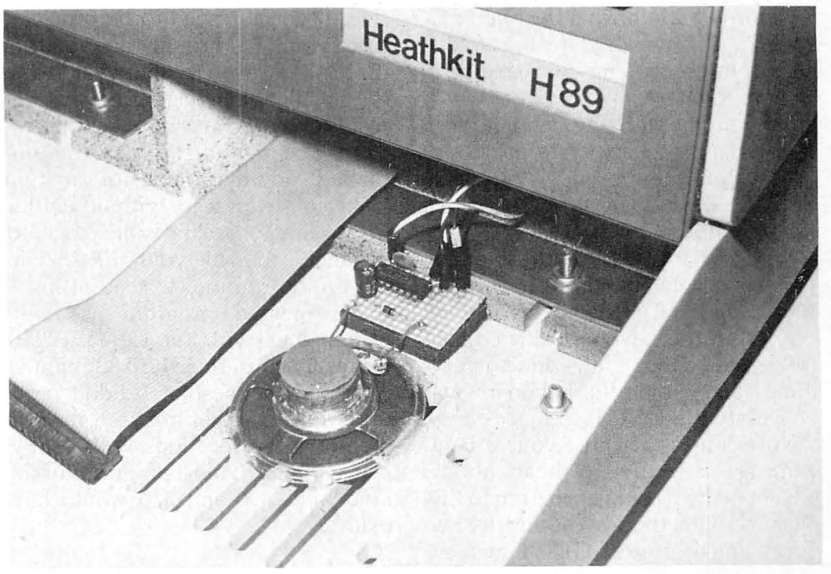
This circuit only uses three parts and may be mounted near the speaker using perfboard. 5 V power for the gates may be obtained using the speaker lead connected to the terminal section's supply. You can ground at any chassis ground point. The Heath construction manual tells the builder to install the speaker under the disk drive, but many H-89 owners have found that the sound of the speaker is better if it's relocated under the keyboard. The photograph of the finished modification shows both the perfboard and speaker in this new location.

I've made two demonstration programs which use the flip-flop toggled by bit 4 of output port 362 (pin 16 of the connectors). The first is a simple routine to create a sawtooth frequency, which will result in a siren-like sound. The second routine scans a data table to obtain duration and frequency information so that any sequence of tones may be played. The location of the data table is identified in the second and third bytes of the program. The table consists of alternating bytes determining the duration and frequency of each tone. If the duration byte is zero for any tone, the program ends. Refinements of these two programs should provide interesting results.

With this modification, your H-89 need no longer bow its CRT to those computers with fancy music routines. The all-in-one computer can now sound off to the world.■

```
000   041 ppp qqq        LD HL,Table    Load HL with Table Address
003   176        Load    LD A, (HL)     Get Duration
004   247                AND A          (sets Z flag if zero)
005   050 037            JZ End         Stop if zero
007   117                LD C,A         Save Duration
010   043                INC HL         Move table pointer
011   176                LD A, (HL)     Get Frequency
012   127                LD D,A         Save Frequency
013   043                INC HL         Move table pointer
014   076 020    Tone    LD A,020
016   323 362           OUT 362         Turn on Output
020   102                LD B,D         Load delay from D
021   005        Wait1   DEC B          Subtract one
022   000                NOP            Slow
023   000                NOP                 It
024   000                NOP                   Down
025   040 372            JNZ Wait1      Loop if not done
027   257                XOR A          Make A zero
030   323 362           OUT 362         Turn off Output
032   102                LD B,D         Load delay from D
033   005        Wait2   DEC B          Subtract one
034   000                NOP            Slow
035   000                NOP                 It
036   000                NOP                   Down
037   040 372            JNZ Wait2      Loop if not done
041   015                DEC C          Decrement Duration
042   040 350            JNZ Tone       Loop if not done
044   030 335            JMP Load       Get next Tone
046   076 003    End     LD A,003
050   323 362           OUT 362         Return FF's to normal
052   311                RET            Go back.
```

Music routine.



H-89 with keyboard assembly removed to show new location of speaker and placement of perfboard.

Here's a chance to pick up some good machine-language programming practices and, at the same time, build an uppercase-lowercase lock routine for your TRS-80 typewriter.

Memory Size—Who Needs It?

By R.S. Lewis

Isn't it a bother to look up memory size every time you want to use an assembly subroutine? If you own a TRS-80 with a disk system, you don't have to do it—you can make your subroutines do it for you.

There's nothing secret about the method. The answer's on page 23 of the TRSDOS version 2.2 fact sheet, though Radio Shack wants to complicate matters by having you make an entry through DEBUG, which is an even worse pain than entering a memory size.

The solution is shown in the assembly listing in Listing 1. The program, incidentally, is an economical way to get your TRS-80 to operate like a typewriter if you've installed a lowercase conversion in it, such as the Pencil conversion, or the one explained in Steven Wexler's article "Lowercase for the TRS-80" on p.132 of the April 1980 *Microcomputing*.

Before I get into what the main program does, however, let's take a look at the housekeeping routine beginning in line 290.

The routine starts by saving the HL registers. That's always a good idea unless you know exactly what DOS or Basic was doing with them just before you took over.

Line 300 loads the address of the keyboard conversion routine GETIT into HL. Line 310 then loads that address into the keyboard device control vector. Once that's done, everything you type on the keyboard will be shunted to GETIT.

Now comes the thing you've been waiting patiently to hear about. GETIT is the working program in this package with the lowest address, so you want to protect GETIT and everything above it with a proper memory size. You do that by decrementing the HL register in line 320 and then loading the address in HL into the memory size block, which is 4049H as advertised by the Radio Shack fact sheet. Now when you go into Basic after calling this program, you'll be able to ignore the memory size question and simply press enter. Memory size will already have been taken care of.

In lines 340 and 350, the program loads the video device control vector with the address of LWRCSE so that everything to be displayed will go to Wexler's routine. Finally, in lines 360 and 370, the housekeeping routine cleans up by recovering HL and jumping back to DOS READY.

There are two more things I ought to point out about the housekeeping routine before I tell you how the program works.

First, notice that the housekeeping routine isn't protected by memory size. It doesn't need to be protected since you'll only run it once and then throw it away. By putting it below the machine-language programs you want to save, you can make this kind of routine any length you want, and make it do any number of one-time tasks you want it to, without cluttering up memory. This is the place, for instance, to put your RS-232 initialization routines instead of inside the protected program as Radio Shack does with the DECWRITER driver listed in their RS-232 manual.

Second, notice that I didn't try to reset the device control vectors or the memory size locations with DEFW instructions. In most programs of this kind lines 300 and 310 would have read:

```
300    ORG    4016H
310    DEFW   GETIT
```

The problem with this approach is that although it works fine with tape, you can't use Tapedisk to save a program that starts at 4016H and ends at FFF9H.

The Program Explained

After these revelations anything I say about the rest of the program would be anticlimactic, but I'll tell you about the program anyway.

First, you need to get it into your editor/assembler and assemble it. Once you have an object tape, go to Tapedisk and read in the tape. File it with the F command as follows: F TYPE/CMD:0 FFA3 FFF9 FFA3. If you're working with 16K, the addresses are 7FA9 7FFF 7FA9. If you have 32K, use BFA9 BFFF BFA9.

If you're wondering why the 48K version stops at FFF9 instead of FFFF, you haven't been reading Radio Shack's newsletters. When you're writing high-memory assembly programs you want to stay out of the last six bytes in the 48K system. Strange things happen up there. Those last six bytes are only good for a four-letter word with two left over anyway.

Now, in DOS-ready mode, type TYPE. The machine-language system will load, and you'll get a DOS READY again. Flip the switch on your lowercase conversion kit and hit the shift-down arrow. Start typing and you'll be typing lowercase letters. The shift works exactly the way it works on a standard typewriter.

R.S. Lewis (20 Grand Ave., Manitou Springs, CO 80829) is president of H.S.D., Inc., a software developer for custom and off-the-shelf applications.

The shift-lock is the shift-down arrow. It's similar to the Electric Pencil's shift, except you don't have that long stretch between the shift and the break key.

If you don't have disk, you can modify the program as follows and make it work: First delete lines 320 and 330. You'll have to set memory size manually. Second, change line 370 to read, JP 1A19H ;RETURN TO BASIC. Third, change line 570 to read, GETIT CALL 03E3H ;SCAN KEYBOARD. Finally, on the bottom line, 1180, add the origin address after END. For 48K, the line would read, END 07FA9H.

Assemble the program and make an object tape. When MEMORY SIZE appears, reserve memory starting one byte above the origin. Go to SYSTEM and load the tape using whatever name you assigned it. When the prompt comes back enter a slash and hit enter. You'll now have your typewriter.

Unfortunately, in this tape version, you don't throw away the housekeeping routine. But you can still do that and save memory by using DEFW statements. To make that change, throw out lines 220, 290 and 360 in addition to 320 and 330. Rewrite lines 300, 310, 340 and 350 as follows:

```
300     ORG     4016H
310     DEFW    GETIT
340     ORG     401EH
350     DEFW    LWRCSE
```

Then add a new ORG line like this:

```
370     ORG     0FFB8H
```

to get the rest of the program into its proper place. Don't use an address after END in this version.

When you get ready to load the result, protect memory starting one byte below 0FFB8H, or whatever origin you used in line 370. Use the break key after loading to get back to Basic. The housekeeping routine will still do its job, but it won't have to reside in memory. If setting memory size annoys you, you'll just have to get that disk.

TYPE/CMD can be just the beginning of a whole system of subroutines. If you're using a serial printer you may want to add a driver along with bells and whistles such as Allan J. Domuret's line-limiting feature ("Uppercase/Lowercase Utility for the TRS-80," March 1980, p.38), or a page-limiting feature. You can add any programs you want below the listing for TYPE/CMD, as long as you make sure you change any device control block vectors that are affected and reset the origin in line 220 so that the program stays within available memory. Provided your add-ons stay below GETIT, you don't have to change the memory size protection entries in lines 300 through 330.

On the other hand, if all you want is standard typewriter capability on your TRS-80, "TYPE/CMD" is a cheap way to get it. The price is only 66 bytes of memory. ■

Program listing. Assembly listing of TRS-80 typewriter programs.

```
                00100 ;PROGRAM "TYPE/CMD"  VERSION 1.1
                00110 ;04/24/80
                00120 ;BY R.S. LEWIS
                00130 ;BOX 992
                00140 ;MANITOU SPRINGS, CO 80829
                00150 ;
                00160 ;****** SET THE ORIGIN ******
                00170 ;
                00180 ;16K ORG = 07FA9H
                00190 ;32K ORG = 0BFA9H
                00200 ;48K ORG = 0FFA3H
                00210 ;
FFA3            00220         ORG     0FFA3H
                00230 ;
                00240 ;****** HOUSEKEEPING ROUTINE ******
                00250 ;THIS PART OF THE PROGRAM RE-DIRECTS
                00260 ;DCB'S FOR THE KEYBOARD AND THE SCREEN
                00270 ;DRIVERS AND AUTOMATICALLY SETS MEMORY SIZE
                00280 ;
FFA3 E5         00290         PUSH    HL  ;SAVE IT
FFA4 21B8FF     00300         LD      HL,GETIT  ;PROGRAM ADDRESS
FFA7 221640     00310         LD      (4016H),HL  ;PUT IN KBD DCB
FFAA 2B         00320         DEC     HL  ;PROG LESS 1 BYTE
FFAB 224940     00330         LD      (4049H),HL  ;PUT IN MEM SIZE
FFAE 21E4FF     00340         LD      HL,LWRCSE  ;VID PATCH ADDR
FFB1 221E40     00350         LD      (401EH),HL  ;PUT IN VID DCB
FFB4 E1         00360         POP     HL  ;GET IT BACK
FFB5 C32D40     00370         JP      402DH  ;RETURN TO DOS
                00380 ;
                00390 ;END HOUSEKEEPING ROUTINE.
```

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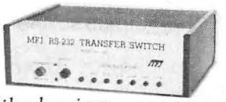
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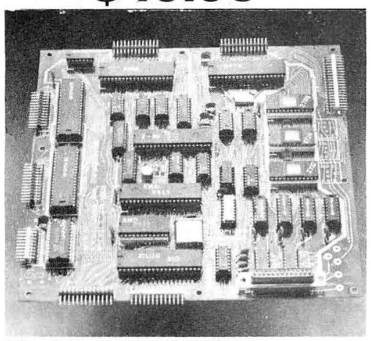
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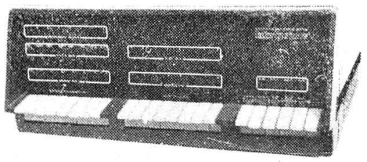
```
                    00400 ;ONCE USED, EVERYTHING ABOVE THIS IS
                    00410 ;THROWN AWAY.
                    00420 ;
                    00430 ;****** UPPER/LOWER SHIFT ROUTINE ******
                    00440 ;THIS PROGRAM LOOKS AT AN INCOMING BYTE
                    00450 ;FROM THE KEYBOARD.  IF IT IS A SHIFT-
                    00460 ;SIGNAL, THE PROGRAM REVERSES THE SHIFT-
                    00470 ;LOCK SWITCH.  IF THE BYTE IS ANYTHING
                    00480 ;ELSE, THE PROGRAM CHECKS TO SEE IF IT IS
                    00490 ;A LETTER.  IF IT IS, THE PROGRAM CHECKS
                    00500 ;THE SHIFT-LOCK SWITCH.  IF IT IS ON, THE
                    00510 ;PROGRAM INVERTS THE LETTER AND THEN
                    00520 ;RETURNS TO THE REST OF THE DOS KEYBOARD
                    00530 ;ROUTINE.
                    00540 ;
                    00550 ;---LOOK FOR AN INPUT---
                    00560 ;
FFB8 CDD843         00570 GETIT   CALL    43D8H  ;SCAN KEYBOARD
                    00580 ;
                    00590 ;---IF IT'S A SHIFT SIGNAL,
                    00600 ;---SEND TO SHIFT LOCK FLIP---
                    00610 ;
FFBB FE1A           00620         CP      1AH  ;SHIFT SIGNAL?
FFBD 281A           00630         JR      Z,FLIP  ;IF SO
                    00640 ;
                    00650 ;---WHAT IS IT?---
                    00660 ;
FFBF FE41           00670         CP      65  ;TOO LOW FOR LTR?
FFC1 F8             00680         RET     M  ;EXIT IF SO
FFC2 FE5B           00690         CP      91  ;UPPERCASE LTR?
FFC4 3806           00700         JR      C,FLOP  ;IF SO
FFC6 FE61           00710         CP      97  ;ARROWS ETC?
FFC8 F8             00720         RET     M  ;EXIT IF SO
FFC9 FE7B           00730         CP      123  ;GRAPHICS?
FFCB D0             00740         RET     NC  ;EXIT IF SO
                    00750 ;
                    00760 ;---IT'S A LETTER---
                    00770 ;
FFCC F5             00780 FLOP    PUSH    AF  ;SAVE IT
FFCD 3AE3FF         00790         LD      A,(SWITCH)  ;GET SWITCH
FFD0 B7             00800         OR      A  ;IS IT ON?
FFD1 2002           00810         JR      NZ,INVERT  ;YEP
FFD3 F1             00820         POP     AF  ;NOPE
FFD4 C9             00830         RET         ;EXIT
FFD5 F1             00840 INVERT  POP     AF  ;GET IT BACK
FFD6 EE20           00850         XOR     20H  ;FLOP IT
FFD8 C9             00860         RET         ;EXIT
                    00870 ;
                    00880 ;---FLIP THE SWITCH---
                    00890 ;
FFD9 3AE3FF         00900 FLIP    LD      A,(SWITCH) ;GET IT
FFDC EE01           00910         XOR     1H  ;FLIP IT
FFDE 32E3FF         00920         LD      (SWITCH),A  ;PUT IT BACK
FFE1 AF             00930         XOR     A  ;CLEAR A
FFE2 C9             00940         RET       ;EXIT
                    00950 ;
                    00960 ;---THIS IS THE SWITCH---
                    00970 ;
FFE3 00             00980 SWITCH  DEFB    0 ;IT'S OFF TO START
                    00990 ;
                    01000 ;END UPPERCASE/LOWERCASE SHIFT ROUTINE
                    01010 ;
                    01020 ;****** LOWERCASE PATCH ******
                    01030 ;ROUTINE PUBLISHED IN MR. WEXLER'S
                    01040 ;ARTICLE IN THE 4/80 KILOBAUD.
                    01050 ;
FFE4 DD6E03         01060 LWRCSE  LD      L,(IX+3)
FFE7 DD6604         01070         LD      H,(IX+4)
FFEA DA9A04         01080         JP      C,49AH
FFED AF             01090         XOR     A
FFEE B1             01100         OR      C
FFEF FAA604         01110         JP      M,4A6H
FFF2 FE20           01120         CP      20H
FFF4 D27D04         01130         JP      NC,47DH
FFF7 C36004         01140         JP      460H
                    01150 ;
                    01160 ; END LOWERCASE DISPLAY PATCH
                    01170 ;
0000                01180         END
00000 TOTAL ERRORS

INVERT  FFD5
SWITCH  FFE3
FLOP    FFCC
FLIP    FFD9
LWRCSE  FFE4
GETIT   FFB8
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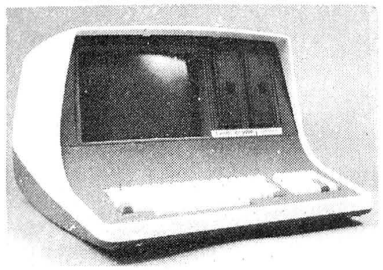
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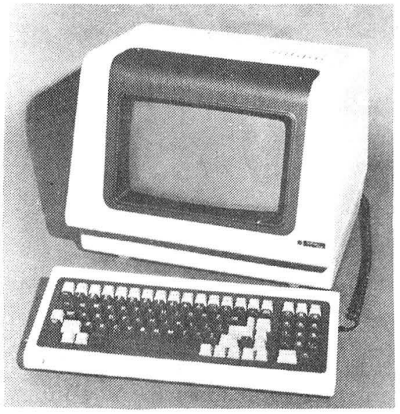
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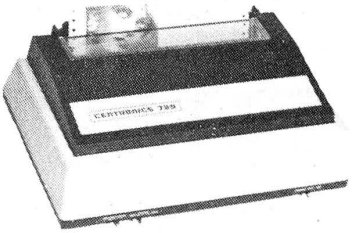
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Information Retrieval—Quick and Dirty

By Murray L. Lesser

Would you like to break the magazine packrat habit? Are back issues filling every available corner of your house and office? Does it bother you when you can't find that article you dimly remember having seen in one of your magazines—only three years ago? What you need is an information retrieval system, one that will find the article you are looking for and let you ignore the rest.

QADIRS is a "programless" information retrieval system. Instead of requiring a special database manager, it uses any line editor that has the *global find* function. While you could use Digital Research's ED (the one bundled in with your CP/M system at no extra cost), I find the features of Microsoft's Edit-80 more convenient. However, if you don't own a suitable line editor, you can use your Basic interpreter in command mode to build the file and a simple Basic program for retrieval.

If you are too insecure to kick packratting cold turkey, you can "index" every article in every magazine, secure in the knowledge that you can always find what you are looking for later—if it exists.

The lineal ancestor of QADIRS is KWIC—Key Word In Context. KWIC was devised in 1959 by the late Hans Peter Luhn, then working for IBM. It was a rather clumsy batch procedure—certainly not necessary for an interactive system such as yours—and is no longer favored in information-retrieval circles. But KWIC was widely used in its day, in spite of its drawbacks. So let us review what it was, how it worked, and how we can eliminate some of its shortcomings in adapting it for use with a modern microcomputer system.

KWIC

Luhn was one of the pioneers in mechanized information retrieval. His major interest was in automatic abstracting. He wanted to program a computer to abstract the key information from articles in professional journals and provide only those abstracts to busy scientists and engineers. As with many of the results of artificial intelligence research, it turned out there was no use for his procedure. In those days, the entire article had to be keypunched (into cards!) from the printed text to get it into the computer to be abstracted, which made the cost prohibitive. Besides, the editors of professional journals were, and still are, insistent that the author provide a human-generated abstract to be printed near the beginning of each article published.

Along the way, Luhn noticed that most titles of technical articles contained many of the key words he was picking up in his automatic abstracts. The title itself tended to be an abbreviated abstract of the paper. This led him to KWIC, first reported in an internal IBM report in August 1959.

Somehow, a review of that report reached the Association for Computing Machinery's (ACM) *Computer Reviews* early in 1960. The reviewer didn't think much of the idea; he claimed to have conducted an "experiment similar in philosophy" in 1952, with dismal results. This didn't stop *Computer Reviews*. It began publishing an annual KWIC index to all the papers that had been reviewed. Those annual volumes are still the best bibliographic source of information on the computer literature published prior to and during the 1960s. For example, the KWIC index entry for Luhn's paper has *Computer Reviews* index number 6013 0094, which keys it to the original review in the journal.

A KWIC index was derived as follows: Each article to be indexed was given an accession number—a serial number that would identify that article to the system forevermore. The only information to be keypunched was the accession number, author's name, title and source. The title portion of the record was manipulated by the KWIC program, which produced a new record for each keyword in the title. All words in the title (except for a few common "stop" words such as "a," "and," "the" and "but") were treated as keywords.

Each new record would contain only the accession number and the rotated title. In the title field, the keyword would come first, followed by the rest of the title, followed by an end mark (perhaps ". . ."), followed by the portion of the title that preceded the keyword.

These index records were then sorted by the title field, and were printed in the KWIC index book in keyword sequence. The complete reference records as originally punched were printed in the back of the book in accession number order, along with an author index keyed to the same numbers.

Address correspondence to Murray L. Lesser, c/o Microcomputing.

```
00068   CP/M ... A Print Utility for
00037   CP/M ... Hardcopy Device Driver Programs for
00039   CP/M ... Start/Exit Routine for
00014   CP/M Compatible Software ... An Overview of
00043   CP/M Encryption Prescription ...
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00066   CP/M Systems ... "Turn-Key"
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00025   CP/M Version 2.0, An 8080/Z80 Operating System ...
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Fig. 1. Portion of a simulated KWIC index.

KWIC indexes were very easy to use. You looked at the section containing the word you were interested in and read through the associated list of titles. If you found a title that looked useful, the accession number would lead you to the complete bibliographic information.

Just to give you a feel of how it worked, I have simulated a piece of a KWIC index in Fig. 1. The strange alphabetizing is the consequence of the strange collating sequence invented by the perpetrators of the American Standard Code for Information Interchange (ASCII).

KWIC suffered from two drawbacks, one intellectual and one practical. The intellectual drawback occurred when the author decided on a cute title that didn't contain sufficient keywords to provide an abbreviated abstract. The solution was to add a little human reviewing—the reviewer would add a few keywords to the record. The result was sometimes referred to as a KWOC (Key Word Out of Context) index. In a KWOC index, the accession number would be followed by the keyword, which was then followed by the nonrotated title.

QADIRS

QADIRS makes use of this added information. For each indexed article with an inadequate title, the user must append the important keywords that might be needed for later retrieval. With a little practice, it is surprisingly easy to do this. You don't even need to read the article in detail; merely skim through it for general content. I have used my QADIRS file to find valuable information in articles I merely glanced through when the magazine arrived.

The practical drawback to KWIC, and its variants, was the necessity of all that rotating and sorting to produce the book, as well as the shelf space necessary to store the multiple volumes. This is now completely unnecessary. With an interactive system on your microcomputer, only one record per entry is produced and the entire file can be kept on a disk. The search for all records containing the keyword or author desired is done on demand, at the time of inquiry.

An excerpt from my QADIRS file, complete with added keywords, is shown in Fig. 2. The format is completely arbitrary; you don't have to use mine if you don't like it. Actually, the hardest part of setting up such a file is choosing a format that will please you.

Each entry in the file is a logical "line" as produced by Microsoft's Edit-80. The separate physical lines within the record are produced by keying LF TAB TAB for each line break. (Use control-J for LF and control-I for TAB if your keyboard does not have these keys.) The sequence numbers are generated automatically by the editor's line-number assignment capability.

To use QADIRS in a CP/M system, merely key in "EDIT80 QADIRS.". The period is part of the call, to prevent Edit-80 from adding the filetype .MAC. This sets up the file for a new entry or retrieval. To add a new item

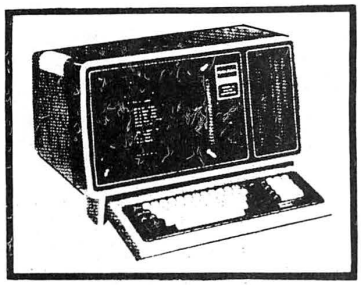
```
00038   Lesser, Murray L.: "Binary Cents and the Smart Checkbook"
            INTERFACE AGE Oct 1980 p70 (BASIC)
00039   Barbier, Ken: "Start/Exit Routine for CP/M"
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00050   Hughes, Lawrence E.: "MFT: A Multiple File Transfer Utility"
            DR DOBB'S Oct 1980 p24 (Assembly 8080 CP/M)
00051   Whaland, Norman: "Interpretive Programming"
            CREATIVE COMPUTING Apr 1979 p124 (Assembly)
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Fig. 2. Excerpt from a QADIRS file.

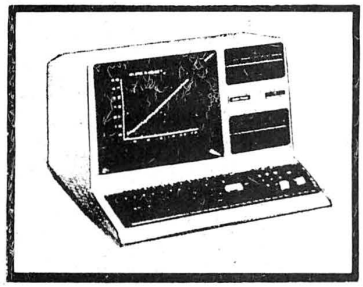


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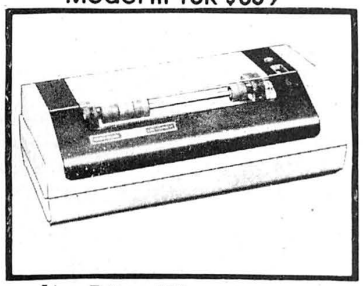
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to the list, use the command "I*,1"—this will automatically assign the next accession number. After you've made the entry, you must write the accession number on the article indexed and file it by number so that you can find it later.

When you wish to interrogate the file, you ask to see all records containing a specific keyword by using Edit-80's global find command. This is sufficient as long as you only wish to see the results displayed on your console output. If you want printed output, a little more is required. Edit-80 does not use CP/M's normal BDOS call for output, so the CP/M control-P toggle will not echo this console output to the printer. The Basic program Search, given in Listing 1, will provide printed output.

The result of a search of my QADIRS file for entries containing the keyword CP/M is shown in Fig. 3. If you compare this with the simulated KWIC index given in Fig. 1, you'll note that several entries were found only because I added the keyword not in the title.

If you don't own a suitable line editor, you can use your Basic interpreter in command mode to make entries—providing you can file programs in ASCII format. Just remember to make every line a REM statement. You will have to be careful not to duplicate accession numbers, because Basic interpreters in command mode won't remind you that you are reusing an existing line number. Since most Basic interpreters do not have a global find facility as a portion of their edit function, you will have to do all retrieval by using Search. You

```
00100   '                          ******************
00200   '                          ***   SEARCH   ***
00300   '                          ******************
00400   '
00500   '       Written by M. L. Lesser, 5/19/81
00550   '       Modified 8/9/81 to add abort (line 3700)
00600   '       Written in Microsoft BASIC-80, release 5.2
00700   '       Compiled with BASCOM 5.2, switch/Z
00800   '
00900   '       This program searches a sequential file, <dev,filename>,
01000   '       and lists all records having the imbedded string
01100   '       specified by ARGUMENT.  Any word, or adjacent words,
01200   '       that do not include a <Control-C> may be used as
01300   '       the search argument.
01400   '
01500   '       Call with SEARCH <dev:filename>.  If no <dev:filename>
01600   '       is specified on the command line, the program will ask for
01700   '       input of the <dev:filename> to be searched.
01800   '
01900   '       After a search is completed, the program asks for another
02000   '       search argument.  To leave the program, reply to the
02100   '       input request with a <Control-C>.
02200   '
02300   DEFSTR A,F,T
02400   DEFINT J
02500   LPRINT CHR$(27) "C10" CHR$(27) "9"              'Left margin at 10
02600   CALL PICKUP(FILENAME)                           'Get <filename>
02700   IF LEN(FILENAME) <> 0 THEN PRINT "Searching " FILENAME
              ELSE LINE INPUT "ENTER <dev:filename>: "; FILENAME
02800   LINE INPUT "Enter Search Argument (Control-C to quit): "; ARGUMENT
02900   OPEN "I", #1, FILENAME
03000   LPRINT "Searching " FILENAME
03100   LPRINT "Search argument is " CHR$(34) ARGUMENT CHR$(34)
03200   LPRINT
03300   WHILE NOT EOF(1)                                'Read the file
03400           LINE INPUT #1, TEXTLINE                 'Read a line
03500           IF LEN(TEXTLINE) >= 6 THEN GOSUB 5000   'Remove high-order bits
03600           IF INSTR(TEXTLINE,ARGUMENT) <> 0
                      THEN LPRINT TEXTLINE              'Print if selected
03700           IF INKEY$ = CHR$(3) THEN END            'Abort on Ctrl-C
03800   WEND
03900   LPRINT:LPRINT:LPRINT
04000   CLOSE
04100   PRINT
04200   GOTO 2800
04300   '
05000   'Subroutine:  Remove any high-order bits from first six bytes
05100   '
05200   FOR J = 1 TO 6
05300           IF ASC(MID$(TEXTLINE,J,1)) > 127 THEN LET
                   MID$(TEXTLINE,J,1) = CHR$(ASC(MID$(TEXTLINE,J,1)) - 128)
05400   NEXT J
05500   RETURN
05600   '
```

Listing 1. The Search program



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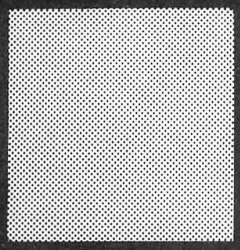
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may wish to have two versions, one to produce output to the console.

The Search Program

A few words about the Search program: As shown, it was written to be compiled with BASCOM (the compiler version of Microsoft's Basic-80) for use with files written with Microsoft's Edit-80 line editor, the results to be printed on a Qume printer. If your system differs, you'll need to make some changes.

Line 2500 sets the left margin of the Qume to column 10. Change or delete it to meet your requirements.

The assembly-language subroutine Pickup, called in line 2600, picks up the name of the file to be searched from the remainder of the CP/M command line. It was given in my article "Compiled vs Interpreted Basic" (*Microcomputing*, Nov. 1981, p. 180). Pickup can be used only with compiled programs, as explained in that article. If you are using an interpreted version of Basic, delete line 2600, and all of line 2700 up to and including ELSE.

Edit-80 turns on the high-order bits in the line number and the following tab. If you are using an interpreted Basic to make your original entries, or some other line editor with different idiosyncracies, omit line 3500 and the subroutine beginning at line 5000.

Compiled Basic ignores messages from the keyboard except when an input is programmed explicitly. Line 3700 is supplied to allow an abort instead of feeding reams of paper in case of error. It can be omitted if you are running Search under an interpreter.

Several other format-free file maintenance applications can be done in the same "programless" manner as QADIRS. For example, I keep a WORK.LST of things to make, fix or buy for the house and boat. Here, the keywords are TODO and WANT. When the task is eventually finished, I use the intra-line editing capability of the editor to change the operative keyword to DONE.

Other applications of the technique are: packing lists for things to be loaded into the car before heading on a trip, shopping lists, lists of important numbers (Social Security, bank account, credit card, etc.) and the like. In these applications, entries are made to the file whenever they are thought of. The entire file can be printed, using Search, by answering the request-for-search argument with a carriage return.

There are many other uses for the technique, limited only by your ingenuity. Why wait to put those useful database applications on your system until you get around to writing, or buying, a suitable file maintenance program? Use your line editor, instead.■

```
Searching QADIRS
Search argument is "CP/M"

00005   Stewart, John F.: "CP/M Primer" MICROCOMPUTING April 1978 p30
00014   Newberry, Steve: "An Overview of CP/M Compatible Software"
            DR. DOBB'S Jan 1980 p8
00025   Miller, A.R.: "CP/M Version 2.0, An 8080/Z80 Operating System"
            INTERFACE AGE May 1980 p134
00037   Willoughby, Steve: "Hardcopy Device Driver Programs for CP/M"
            DR. DOBB'S Sep 1980 p34 (8080 Assembly Print)
00039   Barbier, Ken: "Start/Exit Routine for CP/M"
            MICROCOMPUTING Oct 1980 p82 (8080 Assembly Monitor Jump)
00043   Sclawy, Alan: "CP/M Encryption Prescription"
            MICROCOMPUTING Nov 1980 p42 (Crypto BASIC)
00045   Barbier, Ken: "Relocating the Dynamic Debugging Tool"
            MICROCOMPUTING Nov 1980 p181 (CP/M DDT 8080 Assembly)
00047   Hallen, Rod: "The Master Catalog System for CP/M Users"
            MICROCOMPUTING Dec 1980 p188
00050   Hughes, Lawrence E.: "MFT: A Multiple File Transfer Utility"
            DR DOBB'S Oct 1980 p24 (Assembly 8080 CP/M)
00063   Fritzson, Richard:  "Data on Disk:  Implementing File Systems"
            MICROCOMPUTING Jan 1981 p111 (CP/M Index Block)
00064   Lindsay, Jon: "For CP/M: Automatic Program Execution on Start-up"
            MICROCOMPUTING Jan 1981 p184 (Auto-Load)
00066   Frantz, James J.: "'Turn-Key' CP/M Systems"
            CREATIVE COMPUTING Dec 1979 p104 (Auto-Load BASIC)
00068   Barbier, Ken: "A Print Utility for CP/M"
            MICROCOMPUTING Feb 1981 p150 (Assembly 8080)
00100   Cotton, Gene: "How to Solve Your Damaged Disk Dilemma"
            INTERFACE AGE Sep 1980 p80 (CP/M File Block 8080 Assembly)
00101   Haanstra, Bruce: "Optional Printing with CP/M and Microsoft BASIC"
            INTERFACE AGE Nov 1980 p84 (IOBYTE)
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Fig. 3. Output of the Search program in Listing 1.

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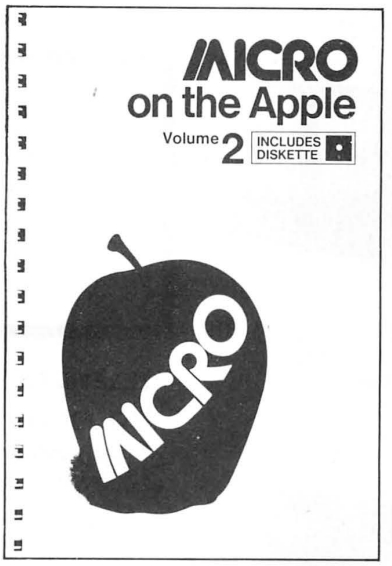
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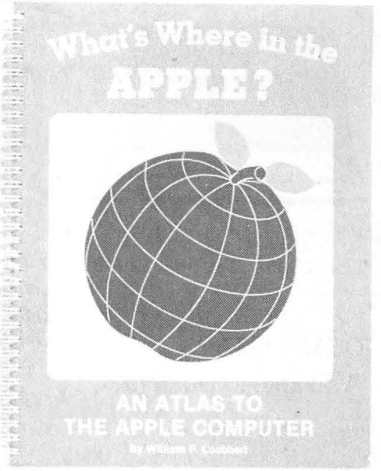
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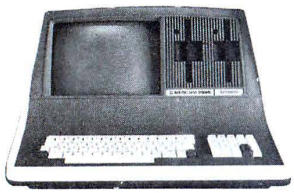
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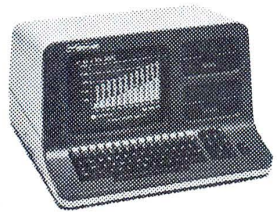
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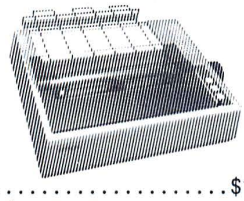
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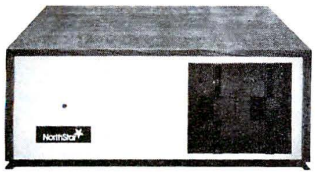
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Find out what you can do to preserve the integrity of your micro's data.

A Shocking Look At Voltage Suppressors

By G. Michael Vose
Microcomputing Technical Editor

Are you the kind of person who thinks that a spike is something a wide receiver does with a football after he scores a touchdown? Or do you believe that a spike is a special kind of heel on shoes worn by the truly elegant and fashionable? Maybe spike makes you think of the Golden Spike that united a continent's railroad system, or maybe it brings to mind what you do to the punch at the company Christmas party each year. I propose to expose you to yet another kind of spike.

This spike is electrical in nature. It comes in two forms—transients and surges. Spikes of electrical current transmitted along ordinary power lines can potentially cause difficulty for sensitive solid-state devices like computers. Therein lies the importance of this story about voltage spikes, radio frequency interference (rfi), electromagnetic interference (emi) and electromagnetic pulses (emps).

The Integrity of Data

As the modern home and office become increasingly reliant on the speed and efficiency of computers for record keeping and data manipulation, data integrity becomes critical. Floppy disk storage of large amounts of important data demands reliability from the computer hardware. The speed and convenience of disks is of no advantage if the failure rate of disk read or write operations is high. The integrity of the computer's memory is similarly critical. If an office manager spends a great deal of time recovering from errors that result from seemingly random memory failures, the gains in efficiency provided by the computer are lost—along with the sanity of the operator.

In 1982 the state of the microcomputer art is such that the hardware itself is very reliable. The quality of the training provided for computer operators is a variable in the reliability formula. Another variable, not often recognized, is the quality of the support environment in which the computer is located. One of the few things that the computer needs from the outside world is electrical power—clean, uninterrupted power. Unfortunately, traditional sources of electrical power are seldom clean and uninterrupted.

Power Problems

Electrical power can be suspect for a variety of reasons. Interference may be transmitted along utility power lines or it may be generated within a building or room by a number of sources. The kinds of electrical interference that can affect computer devices include voltage above or below the normal voltage for the system (called spikes, transients and surges, dips, sags or brownouts); and noise interference (often called "hash" by electrical engineers). According to studies by the Institute of Electrical and Electronics Engineers (IEEE), harmful power line disturbances occur, on average, four times a day. Of the disturbances, 88 percent are power spikes (transients and surges), 11 percent are brownouts (low voltages) and 0.5 percent are power outages.



The Glitch Sentinel GS-2 from Billings McEachern. Sounds an alarm and prints a record of every power line disturbance. Filters voltage imbalances and noise. $900.

The difference between transients and surges is strictly one of duration and degree. A transient is a voltage increase to 6000 volts or higher lasting 100 μs or less. A surge usually lasts slightly longer but is characterized by voltages of 3000 volts or less. Voltage surges of 1000 volts are common, everyday occurrences in most industrial and commercial electrical environments.

The most common causes of electrical interference are voltage imbalances generated by electrical machinery. A refrigerator motor or a furnace blower motor can cause voltage spikes and voltage reductions during operation. Other causes of interference include the obvious, like lightning, and the not-so-obvious, such as sunspots.

Spikes and Sags

What kind of damage is caused by increased or decreased voltage? Per-

manent damage seldom occurs to a computer as a result of voltage fluctuation. It *is* possible, in the case of an extraordinary event such as a lightning strike, for sensitive semiconductor devices (such as computer memory chips and microprocessors) to experience circuit melting, corrosion, arcing (which will break down insulation) and a reduction in component life. In mechanical devices, such as disk drives, pitting and metal transfer among switch contacts are possible.

Far and away the most common effect of voltage transients on computing devices, however, is alteration of memory. Small voltage fluctuations can be interpreted by low-power computer circuitry as legitimate input signals. Therefore, it is possible to experience random memory errors as a direct result of electrical interference.

Semiconductor memory chips contain circuitry that comprises hundreds of individual memory cells. These cells are composed of field-effect transistors which act as gates that can either be open or closed, coupled with capacitors that store an electrical charge. During the cycling of the microcomputer's clock, the central processing unit (CPU) writes data to memory at regular intervals. During a write operation, the transistor that acts as a gate is opened and a small electrical charge (for a binary 1) or no charge (for a binary 0) is stored in the accompanying memory cell capacitor. Then the gate is closed.

> The most common effect of voltage transients on computing devices is alteration of memory.

If the data to be written is subjected to a spike or surge during the write operation, a memory capacitor could be set high instead of low. Since a character of information, or byte, is stored simultaneously one bit per chip over eight chips in each 16K of memory, an entire byte of memory could be written incorrectly. If this happened to be a vital byte, an entire data block could be rendered unusable.

Equally critical is the effect of overvoltages on disk drive units. Since the read/write head in a floppy disk drive is designed to alter magnetic fields, voltage spikes often cause the head to alter the data on a disk even when the head is engaged in a read operation. These alterations will occur randomly; however, since the disk reads the directory more than other tracks on a disk, the probability that a random glitch will alter the directory is high. When this occurs, the entire disk becomes unusable.

Voltage spikes are most likely to occur from the switching on or off of an electric motor. Copy machines, elevators, air conditioners, printing presses, furnaces, etc., all generate voltage spikes. These spikes are experienced within the building where the equipment is located, and are transmitted to all parts of the building along the electrical wiring. Low voltage, commonly called a dip or sag, often occurs as a 5-20 percent voltage reduction lasting about a second, and results from a sudden call for power by an electrical device. Low voltages can cause the picture on a television screen or video monitor to shrink visibly for a brief moment. Commonly, low-voltage periods are followed immediately by a high-voltage surge as the system draws power from the outside to satisfy the needs of its consuming devices.

Brownouts are long-term voltage reductions, typically 5-8 percent. They usually are gradual in nature and may last from several minutes up to several hours. Brownouts are initiated by the utility supplying the power, usually due to equipment failure or excessive demand by the power grid. Because they occur gradually, brownouts seldom cause difficulty in computers since the power transformer in the computer adjusts the incoming power to suit the needs of the system. These transformers are ideally suited to accommodating gradual power fluctuations.

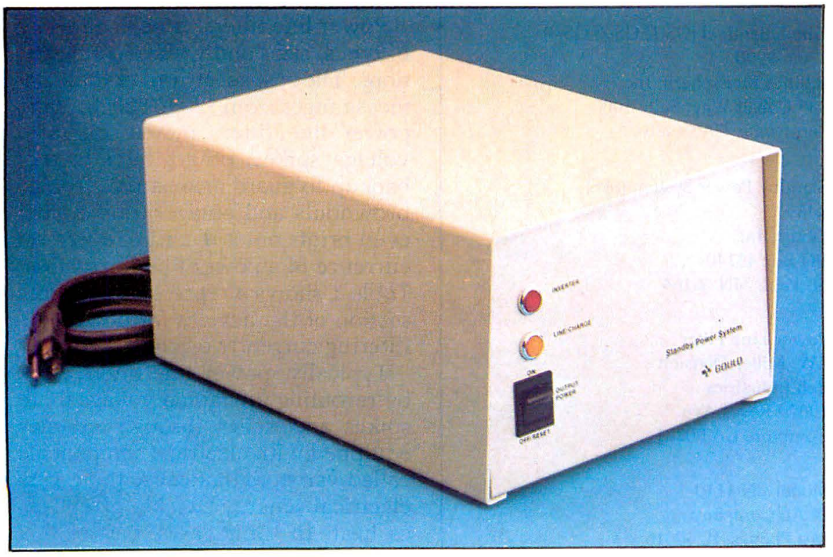
Noise Interference

Voltage fluctuations are the more serious of the two kinds of electrical interference, but noise interference comes in a greater variety of forms. This interference is simply an unwanted electrical signal, and could be as unobtrusive as a jolt of static electricity. Anyone who has ever worked in a computer room without antistatic carpet knows that static electricity can cause data loss in computers.

The common forms of noise are:

- Radio frequency interference (rfi) caused by the reception of electromagnetic signals by power lines acting like antennas.
- Electromagnetic interference (emi) caused by a fluctuating magnetic field such as that produced by an operating electric motor.
- Electromagnetic pulse (emp) caused by a collapsing magnetic field such as lightning. Static electricity is an emp.

Noise interference occurs at lower magnitudes than voltage spikes and is, consequently, less dangerous to equipment. However, it can more frequently degrade performance and cause data loss in computers. This is



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TII Electonics Division
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21. Standby Power System (SPS)
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22. Power Line Filter
J.W. Miller Division
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23. Model CN-1110
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Des Plaines, IL 60016

Table 1. Power line filtering equipment.

because noise interference occurs at extremely high frequencies and high speeds. The response time for most power transformers is not fast enough to trap these high-speed signals.

Noise can be generated by many common devices such as fluorescent lights, radio and television transmitters, electric typewriters, hand tools, automobile ignition systems and sunspots. Computers themselves generate some rfi, and their electrical components, like disk drive motors and power supplies, generate emi. Loose electrical connections and damaged power cords are other sources of noise.

What Can You Do About Spikes and Noise?

The obvious solution to the problem of "dirty" power lines is to incorporate some sort of filter into the distribution system. In much the same way that an oil filter extracts impurities from your car engine's motor oil as it courses through the block, a power line filter can knock down voltage transients and eliminate noise. This is done using circuitry specially designed to handle the offending voltage fluctuations.

The obvious solution to the problem of "dirty" power lines is to incorporate some sort of filter into the system.

Power line filters come in a variety of types, sizes and voltage configurations. The cost spectrum for these devices ranges from $20 to $2000. Some power line filters merely dissipate voltage spikes; others offer battery backup to guard against power sags, brownouts and outages; one system even prints out a record of every occurrence of a power line fluctuation. Table 1 shows a representative cross section of the devices for power line filtering currently on the market.

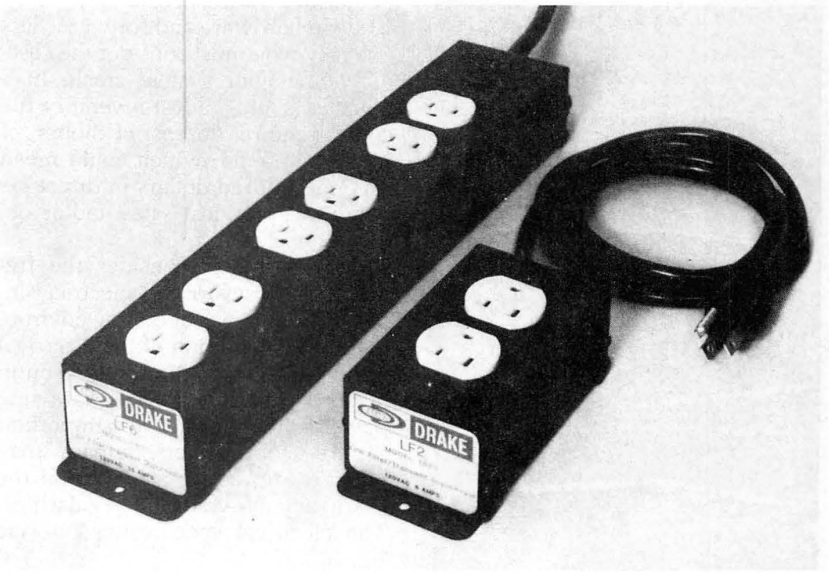
Typically, power line filters work by rerouting unwanted voltage (both spikes and noise) through circuitry equipped with electrical components called varistors that cause the excess electrical energy to be given off as heat. In some cases, part of this excess energy may be diverted to the main electrical system's grounding loop.

Power line filters should be installed between the main source of power and the device to be protected. Normally the power line filter plugs into a wall receptacle and then your computer plugs into the filter. Many filters have an on/off switch so that the circuit can be turned off when your machinery is not in use.

The principal qualities to consider in a power line filter are the overvoltage handling capacity, the response time and the frequency range for noise suppression. Usually a low-cost filter will offer only minimal protection. In fact, the lower-priced filters may offer overvoltage protection only, with no noise suppression capability. Only the most expensive filters offer battery backup for protection in the event of a brownout or power outage.

The overvoltage handling capacity of power line filters ranges from 1000 V to 12,000 V. A capacity of 5000 V will usually protect the line from any spike other than a lightning strike. Many manufacturers call this capability the clamping voltage—this refers to the maximum voltage that will be clamped, or suppressed, by the device.

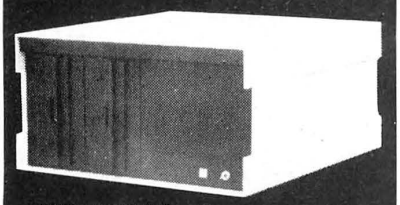
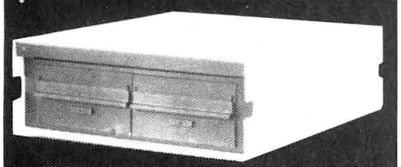
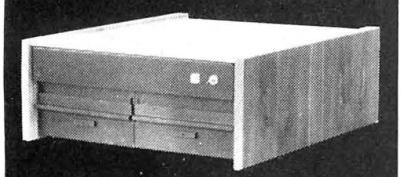
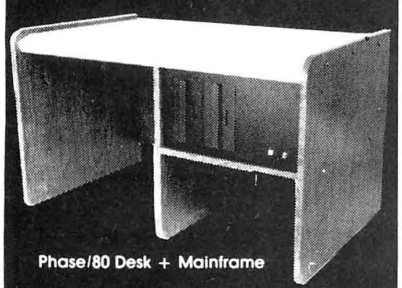
The response time of power line filters typically ranges from 5 to 15 nanoseconds (1 nanosecond is 1×10^{-9} seconds). Noise reduction frequency response is usually in the range of 150 kHz to 30 MHz. Some devices are rated as high as 200 MHz. Unless your building is near a microwave transmission site such as a TV station or a radar installation, an up-



The LF2 (right) and LF6 line filters from R.L. Drake. $39.95 and $59.95.



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per level of 20 to 30 MHz of protection should be sufficient.

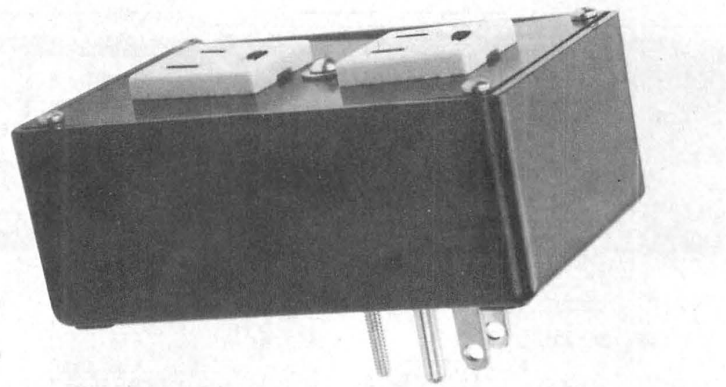
Picking the Right Filter

The line filter that you choose for your particular application will depend on several factors. Principal among these is the investment you've made in hardware and software. Secondarily, you must consider the costs of having your system crash. In a business setting, a lost inventory file could require dozens of hours of labor to rebuild, which could mean several hundred dollars in direct expenditure plus lost sales and/or decreased efficiency.

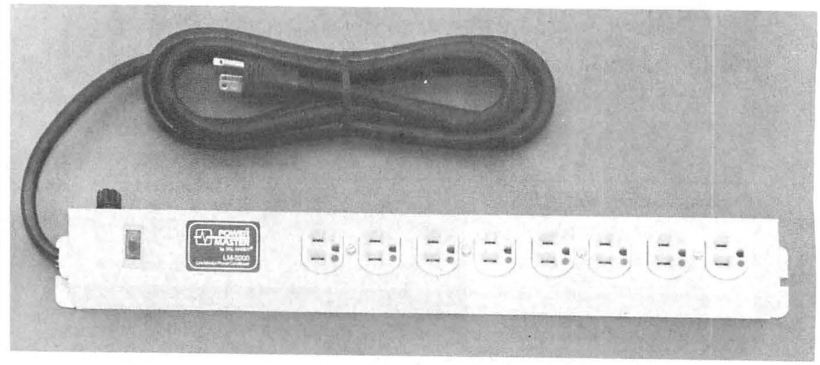
You must also consider the frequency and severity of electrical interference in your operating environment. The condition of the electrical wiring in your building and the number of electrical devices drawing power from the system are important factors. Your power company may be able to produce statistics on the frequency of voltage irregularities. The electrical specifications of the power supply in your computer will reveal the degree of its susceptibility to electrical interference. The manufacturer can usually provide this information.

Finally, you will want to consider the aesthetics of the variety of units on the market. Some unobtrusive devices plug directly into a wall socket, while others feature a multiple-socket design arranged in a so-called power strip. Others are housed in boxes of varying size and color that become part of your computer installation.

Ultimately, you may decide that your computer functions well enough in its present environment. The extra expense of another piece of hardware may be unnecessary. On the other hand, if your machine seems possessed by demons that spontaneously and randomly chew up data or spit out garbage, you may want to consider cleaning up your supply of electricity. Sending nasty notes to the power company is optional. ■



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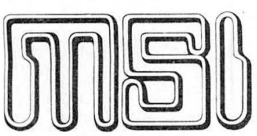
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You can pocket $50 by following this author's instructions in assembling the ZX81 kit.

Exploring Sinclair's Tiny World

By Jerry Martin

I first became interested in the ZX81 when I saw several two-page ads in a computer magazine. I had heard a few things about the ZX80 but had never taken the time to investigate it because of the price and limited memory. But the ZX81 stood out because it had Basic in ROM (read-only memory) and, while still limited to 1K bytes of programmable random-access memory (RAM), could be expanded with a 16K memory module. Information stored in RAM is only in existence as long as the computer has power. ROM is always there and can only be read. So when the ZX81 is turned on it immediately executes the Basic interpreter program stored in ROM, and you're ready to start entering your Basic programs.

What really got my attention was the price—$149.95 for an assembled unit and only $99.95 for a kit. I have always wanted to put a computer together, but I don't have the electronic know-how to design one myself or do my own breadboarding.

Being one who reads the fine print, I looked very closely at the Sinclair ad. It stated that the ten-day money-back guarantee and the limited 90-day warranty, which includes free parts and labor through Sinclair's national service-by-mail facilities, does not apply to kits. So I had to decide whether I was willing to gamble my assembly capabilities for a savings of $50. I would also have to give up the ten-day evaluation period in which I could get my money back.

As I've stated, I'm not an electronic genius. I've put together several Heath-type kits, the most complicated being an FM stereo receiver. But I decided to give it a whirl and sent my $99.95 (plus $4.95 for shipping).

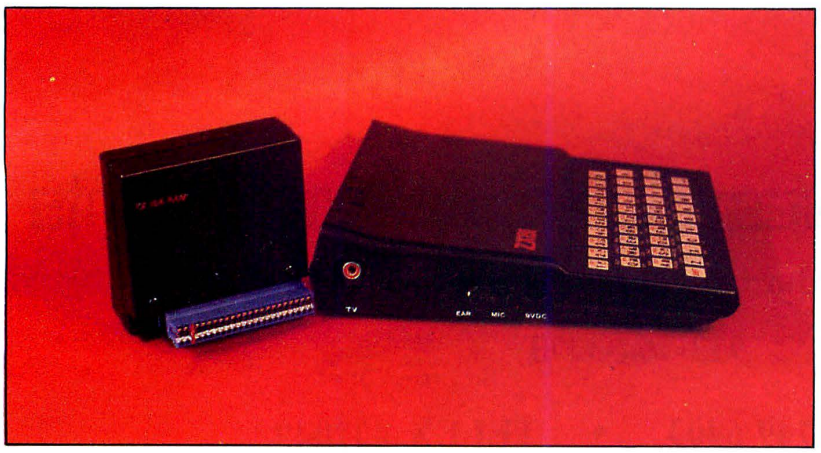
First Impressions

When the computer arrived, I received my first shock—it was so tiny! Photo 1 will give you an idea of the size. It measures 6½ inches wide by seven inches long and is about 1½ inches deep at the back, tapering down to only ¾ of an inch at the front.

The keyboard is six inches wide and 2½ inches from front to back. The keyboard is a nonglare plastic membrane. Photo 2 shows a closeup of the entire keyboard held in the palm of my hand. The keys are arranged in the normal typewriter (QWERTY) manner, and are 7/16 of an inch wide and 5/8 of an inch apart from the center of one key to the center of the next. At first glance this seems to be a bit close but in practice it works out quite nicely. Photo 3 gives a good illustration of the relative size of the keys and their separation.

Now for the nitty gritty—what is it like to put together? Well, it's not too bad. First let's take a look at what you

Jerry Martin (3192 Hiawatha, Columbus, OH 43224) is the coordinator for workshops at the Ohio State University Instruction and Research Computer Center.





The ZX81 uses a standard home television for display and a tape cassette recorder for program storage. A 16K RAM attaches to the back of the computer.

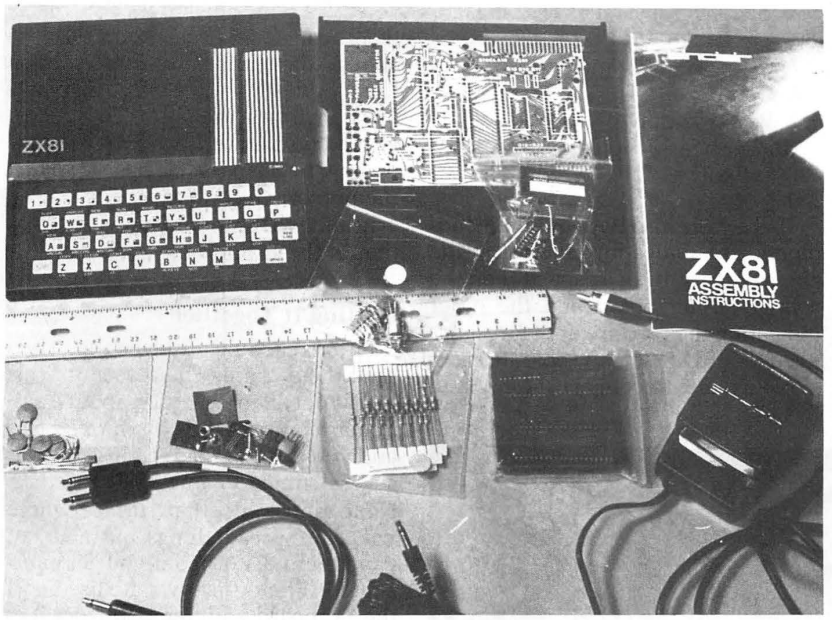


Photo 1. Components, parts and instruction manual contained in the ZX81 kit.

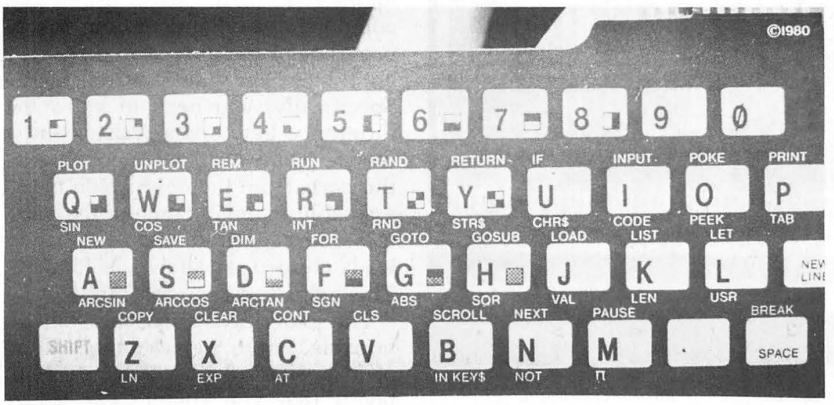


Photo 2. The ZX81's flat keyboard membrane.

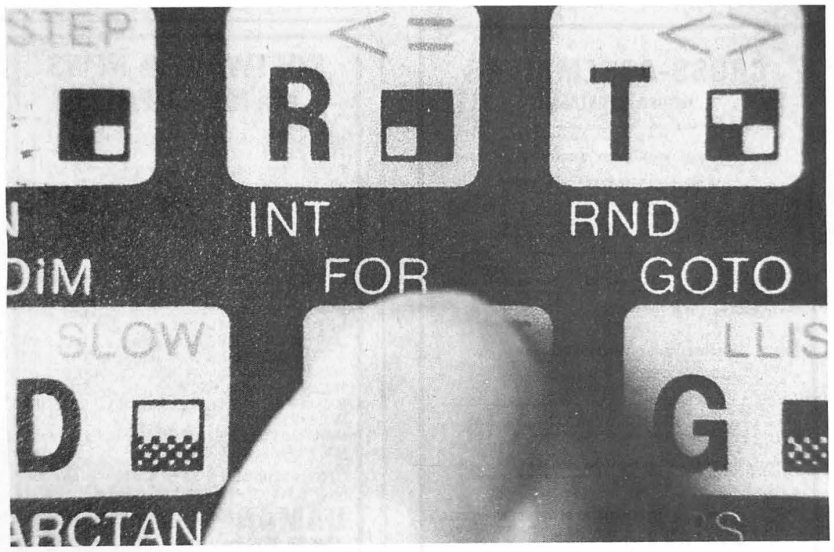


Photo 3. While the keyboard is small and the keys close together, it is still easy to use..

receive in the kit. The major components, being the case and the keyboard, are shown in the upper left part of Photo 1. The white lines above the upper right hand side of the keyboard are very thin plastic cables containing the contacts that plug into the circuit board. The white lines are actually thin strips of copper set in the plastic to form the keyboard cable.

In the upper middle of Photo 1 is the printed-circuit (PC) board with the bottom half of the computer case below it. The ZX81 assembly manual is at the upper right and the power supply is directly below. Cables for the cassette recorder and a connector between the computer and the TV modulator (not shown) are along the bottom of the photo. A handful of parts are strung out in the middle, each in their individual ziplock plastic packages. The five integrated circuits (ICs) are in the packet just to the left of the power supply. Also included, but not shown, is a 164-page ZX81 Basic programming manual which I found to be very good. It is well-written, with a number of examples that aid in understanding the text.

The instruction manual is basically a parts list. The kit includes:

31 resistors
2 resistor packs
12 capacitors
5 integrated circuits
2 transistors
8 diodes
1 ceramic filter

The instructions tend to be brief. For instance, they read "We suggest you assemble the components in the following order:

"i) resistors, capacitors, and IC sockets

"ii) the diodes and transistors. . ." Heathkit instructions they are not, but diagrams show how the major components are installed and the PC board has all the components clearly marked as to where, for example, capacitor C1 goes. All you need to do is identify capacitor C1 (the markings are indicated in the parts list) and install it in the appropriate place. It is necessary to read the instructions through before starting assembly. If you don't, you will be sorry. I did and I was still sorry, but more about that later.

The instructions are broken into seven major categories:

1. Preparation (what you will need)
   a. 15 to 20 W soldering iron

b. Resin solder
c. A pair of sidecutters
d. A small phillip's head screwdriver
e. I also found needle nose pliers handy

2. Precautions (don't zap your ICs with static electricity)
3. Component identification
a. If you know the difference between a transistor and a diode this should not be a problem
4. Circuit board assembly (brief but adequate)
5. Testing (check your soldering)
6. Fault finding (a few things to look for)
7. Case assembly (no sweat)
8. Component list
9. Power supply
10. Service (if you mess up send $20 to fix it)

There were also two minor amendments, one indicating an error in the polarity marking of a capacitor on the printed-circuit board and the other indicating the placement of a resistor needed for U.S. kits. A separate sheet explains how to connect the ZX81 to your TV, and includes U.S repair facilities and prices, some more about kits (*important information here!*), and the address for technical assistance or spare parts. There were also a few pointers for ZX80 owners on how to clean the PC board if a 16K memory module does not work properly and where to find more information in the U.S. on the ZX81.

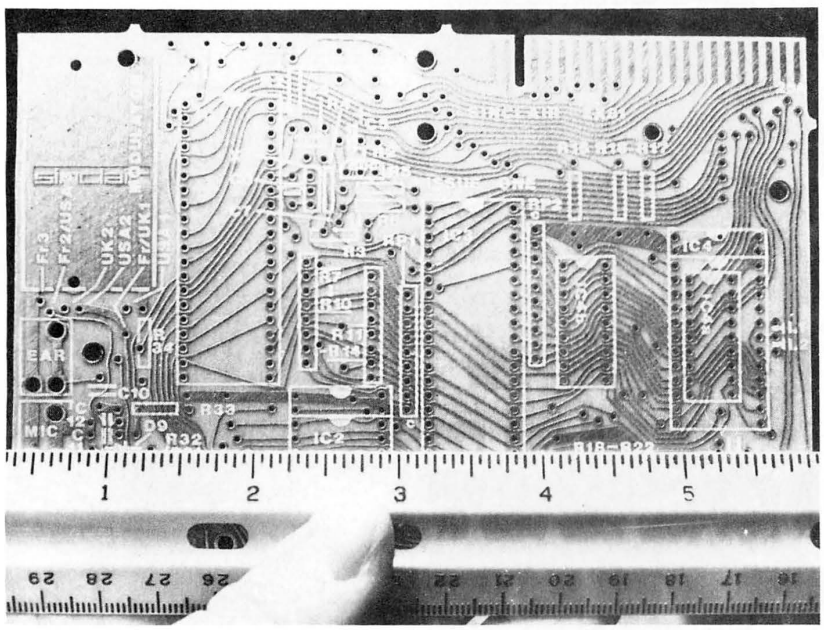


Photo 4. The parts are outlined and identified on the PC (printed-circuit) board.

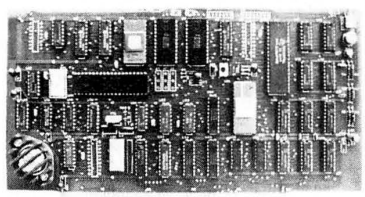
Putting It Together

First, read the instructions. Then read them again. The reason for this is that not all information about a particular component is all in one place and you need to read the instructions several times to put it all together. Next, find a nice flat surface where you can spread things out and not have them disturbed if you get interrupted. Photo 4 shows a close-up of the PC board with the parts' outlines shown on the board itself. This is the side the parts are mounted on. Just identify, from the parts list, which component is C4 and put it in the appropriate place. This is not difficult if you're familiar with electronic parts. Specifically, you need to know the difference between a resistor and a diode. I had no trouble identifying the parts from the description in the assembly manual. Some of the resistors and capacitors even have their leads clipped, as shown in Photo 5. This helps speed up assembly.

The soldering is fairly close but not horrible. Photo 6 gives an indication of the side of the printed-circuit board that you solder. The solder

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points are about two millimeters apart. The ruler is in centimeters and each centimeter is equal to ten millimeters. This side of the board is masked with a green plastic overcoating, so the chance of solder bridges with the dense circuit traces is reduced. The soldering is really quite simple and should not pose a problem if you have some experience with soldering on printed-circuit boards.

Helpful Hints

Pick out all of the resistors, put them in and solder them. Most go flat but some have to be inserted upright. See Photo 7 for a close-up of how the upright ones are installed. The assembly manual also shows how these are to be installed.

Next install the two resistor packs. These are two long narrow things, one with nine leads and the other with six leads. They are referred to as RP1 and RP2, respectively. Here is where I messed up. These must be installed with the black square (or white dot) oriented toward the C mark on the PC board. This is one case where the instructions were not where I would have expected them to be. I installed both backwards and, let me warn you, once you have put them in don't hold any hope for taking them out undamaged!

Fortunately, Columbus, OH, has a very well-stocked electronics distributor, and I was able to replace them for only $1.13. However, I could not locate a nine-lead pack, and had to buy a ten-lead instead. I cut off one lead and put tape around it to prevent any contact with the PC board. If you look closely at Photo 8, in the middle just to the right of the large IC marked D780C-I, you can see the tape I placed on the tenth pin of the resistor pack. That IC, by the way, is the Z-80A microprocessor.

Next install the capacitors, ceramic filter, transistors and diodes. Photo 9 shows a close-up of the orientation of the diodes. The wide band should be toward the top as shown.

Next to last comes the keyboard power and cassette connectors, volt-

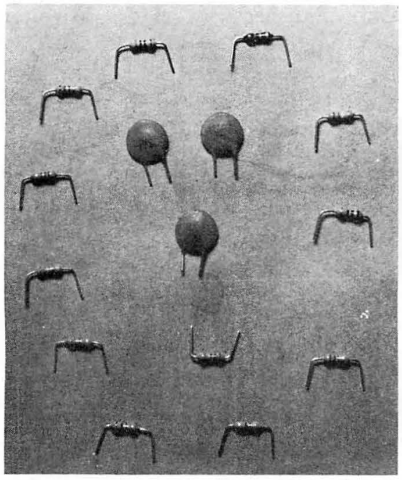


Photo 5. Capacitors (the circular ones) and resistors used in the ZX81.

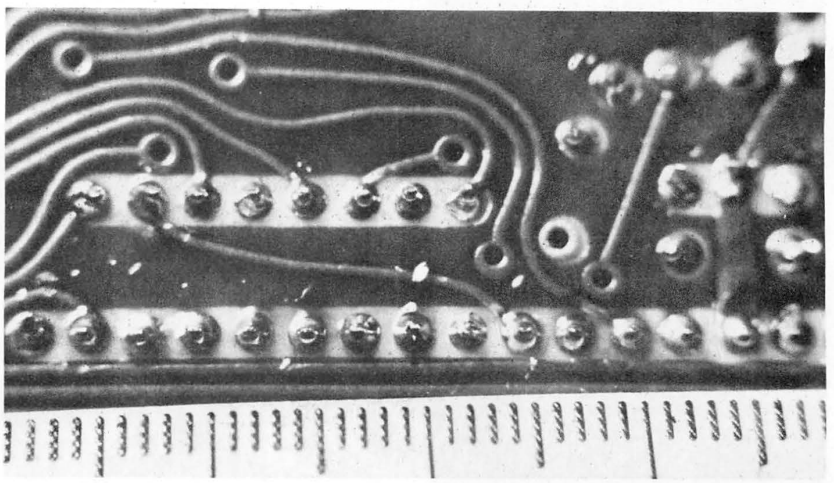
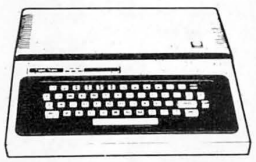
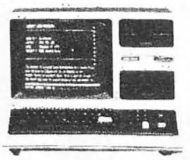


Photo 6. Solder points on the back of the PC board are about 2 millimeters apart as the centimeter ruler indicates.

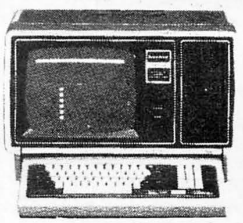
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age regulator and integrated-circuit sockets. The sockets should be oriented with the notch in the same direction as the printed-circuit board indicates. Photo 10 gives a close-up of how the voltage regulator is installed.

Next comes the modulator. Be sure to double-check the connections on the modulator before you solder it. The connectors should go to the UK1 and UK2 holes (see the upper left of Photo 4). Now you can insert the ICs in their sockets. The integrated circuits need to have their pins bent to fit in the sockets. Beware of static electricity when handling the ICs, as they are the most expensive and sensitive items in the ZX81 computer.

Look at Photo 8 for the placement of the ICs. Starting from the left there are two small chips; these are the RAM chips. Note that the left one has an outline for a larger IC. The ZX81 was designed to be able to use two ½K ten-pin RAMs (shown), one 1K 24-pin IC or a 2K IC. At present only the 1K ICs are supplied with the ZX81 but as the price drops the 2K chips may be used without having to change the circuit board.

The third IC to the right is the large 40-pin Z-80A microprocessor which is the brain of the ZX81. The next IC to the right and slightly up is the 8K Basic ROM. In my kit this is a 24-pin IC, but a 28-pin socket is provided. (In Photo 4 right above my thumb you can see that the IC2 marking has two sizes shown.) If the IC is smaller than the socket, it goes toward the edge of the printed-circuit board as Photo 8 illustrates. The last integrated circuit has 40 pins and is the Sinclair's I/O (input/output) logic IC, which takes care of the cassette, TV and printer I/O functions.

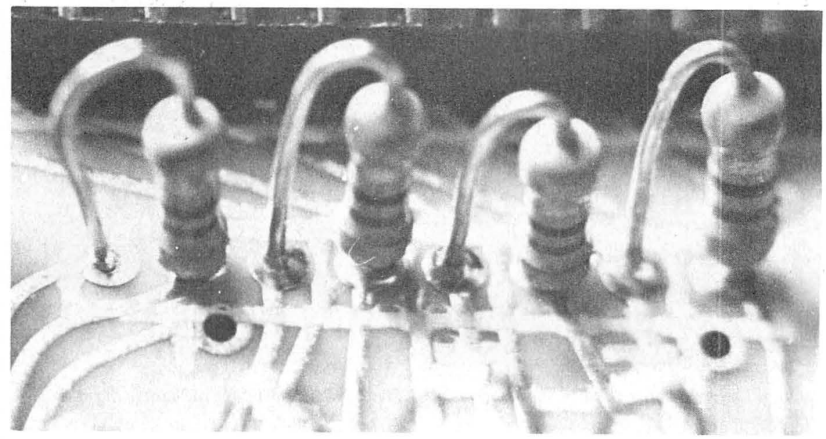


Photo 7. While most resistors are installed flat on the PC board, a few (as shown) are installed on end.

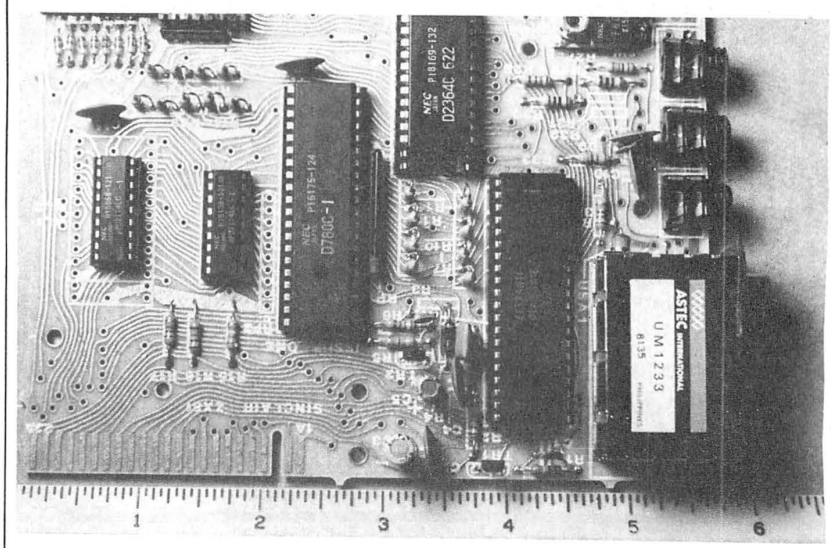


Photo 8. Completed PC board.

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This is an expanded debugger which has all of the features of Debug I plus many more. You can "trap" (i.e. trace a program until a set of register, flag, and/or memory conditions occur). Also, instructions may be entered and executed immediately. This makes it easy to learn new instructions by examining registers/memory before and after. And a RADIX function allows changing between ASCII, binary, decimal, hex, octal, signed decimal, or split octal. All these features and more add up to give you a very powerful development tool. Both Debug I and II must run on a Z80 but will debug both Z80 and 8080 code. $99.95/$20.

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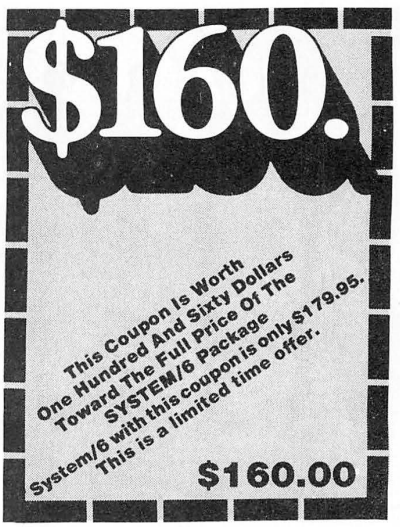
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The last, but perhaps the most important, step is plugging the ZX81 in to see if it works. Sometimes this is referred to as the smoke test. If it starts smoking something is probably wrong. Actually, before plugging it in you have to temporarily connect the keyboard. I found this to be the most difficult part in the entire assembly. The keyboard connectors are a very thin plastic and just did not want to go into their sockets. You can see the sockets on the upper left hand of Photo 8. It took me almost ten minutes to plug the keyboard in, and I was almost ready to cry about it. I could just see myself at the last step of assembly, not being able to plug the keyboard in the socket. After a few choice words and spreading the socket pins with my knife I was finally able to insert them. With trembling hands I connected the TV and inserted the plug into the power outlet, and surprise, surprise, it worked the first time!

It took a little fine-tuning on the TV to get things just right. The ZX81 transmits to channel 34 and there just happens to be a local TV station that transmits on the channel. It does not seem to cause an excessive amount of interference, however (see Photo 11).

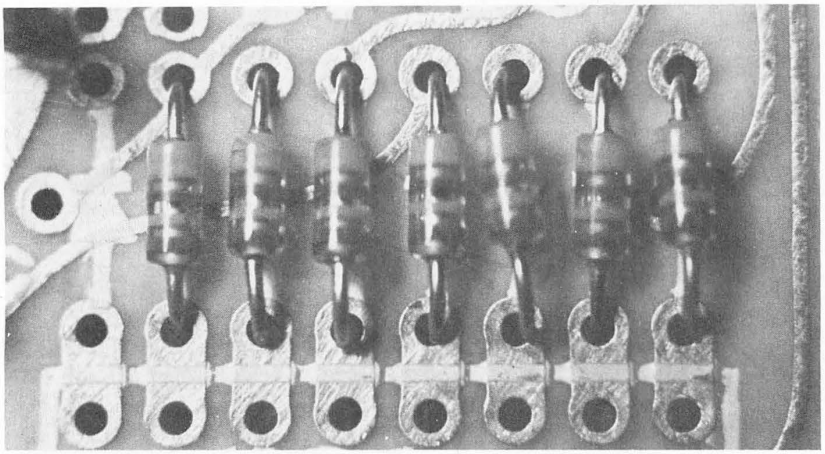


Photo 9. Diodes should be installed as shown with the wide bands toward the top of the board.

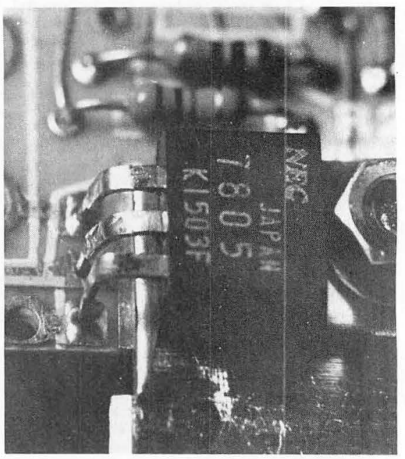


Photo 10. The installed voltage regulator.



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The last item is, of course, putting it all together in the case and tightening the screws. The instructions are quite clear on just how this is done, and the only trouble I had was convincing myself I could insert the keyboard connectors again. Indeed, it only took half as much time.

Can You Put It Together?

If you have some experience putting together kits you should not have any difficulty assembling the ZX81. While a few points are not clear in the instruction manual, this article should help clear them up. I think the biggest problem is finding all the pertinent material about a particular component in the instruction manual.

It took me about six hours to assemble the ZX81, and that includes taking pictures and answering questions posed by a four-year old who closely monitored my progress. ■

[Editor's Note: *According to Sinclair, some users have complained of intermittent problems resulting from movement of the PC board when the ZX81's case is flexed as when certain areas of the keyboard are pressed. Sinclair has already introduced a modification to remedy these problems with their kits. If you have an older kit, check with Sinclair.*

We are told that Sinclair is also planning to supply stronger cassette I/O and power supply jacks with the kits. HN]

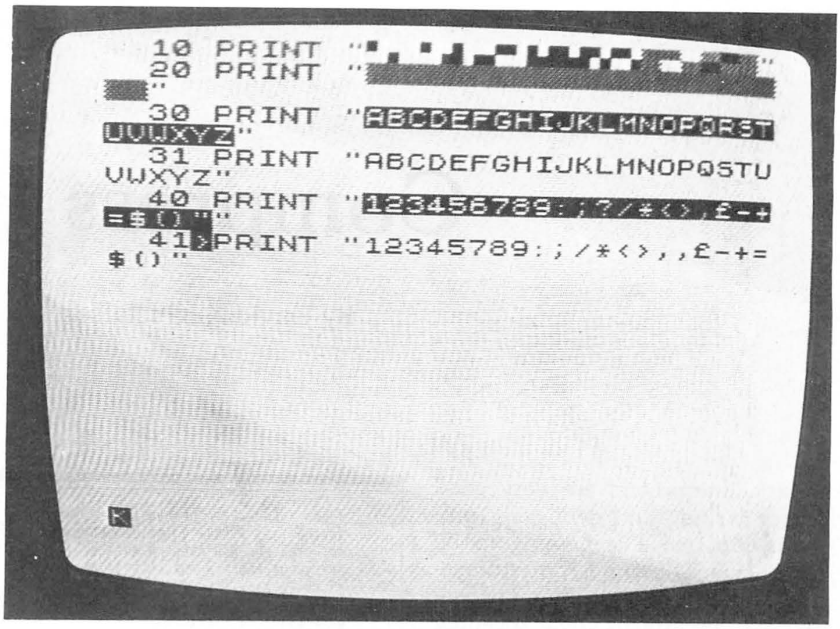


Photo 11. Video display of the completed ZX81 using a black and white TV.

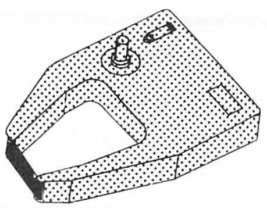
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Here's a different approach to improve memory efficiency and execution time on your North Star system.

Compress It!

By David K. Gustafson

Basic interpreters are very good for writing and debugging programs, but leave something to be desired when it comes time to execute the final program. Many people have written articles about speeding up Basic programs, but most of them are concerned with programming techniques. In this article, I will present a different approach.

Our North Star Basic system is very good, but suffers from a drawback common to interpreter Basics. If a program is written so that it can be easily read and understood, it occupies more memory than necessary and executes more slowly than necessary.

> The program will execute faster because there will be fewer lines to search and fewer characters to interpret.

With the three programs presented here, it is possible to originate, test and debug a Basic program, and then compress the program for minimum memory usage and maximum execution speed. North Star Basic uses four bytes for each line number and only one for statement delimiters. When many statements are concatenated on one line and unnecessary spaces

```
10REM  PROGRAM TO REMOVE SPACES, REMARKS, EXTRA LINES, ETC. FROM BASIC PROGRAMS
30DIMA(132),B(256),C(132),L(500)\!"DISK WITH PROGRAM MUST BE IN DRIVE 1"
40!"DISK FOR NEW PROGRAM MUST BE IN DRIVE 2"
50!\INPUT"PROGRAM TO COMPRESS ",F$
60IFFILE(F$)=-1THEN350
70IFFILE(F$)<>2THEN360
80OPEN#0%2,F$,L\F1$=F$+",2"
90IFFILE(F1$)<>2THENCREATEF1$,L,2
100OPEN#1%2,F1$\N0=1\N1=1
110READ#0,$B0\IFB0=1THEN140
120FORI=2TOB0-1\READ#0,$B\IFB=154THENGOSUB420\NEXT
130READ#0,$B9\GOTO110
140CLOSE#0\OPEN#0%2,F$\IFL9>0THENL9=L9-1\GOTO160
150READ#0,$A(0)\Z=0\N1=0
160READ#0,$B0
170A(1)=B0\IFB0=1THEN370
180FORN=2TOB0-1
190READ#0,$C(N)\NEXT\B=B0
200GOSUB1000\REM TO REMOVE EXTRANEOUS SPACES
210D=A(2)+A(3)*256\FORI=0TOL9\IFD=L(I)THENEXIT240\NEXT\REM SEARCH FOR LINE # REFERENCE
220IFB1+B0>255THEN330\REM WRITE OLD LINE & COPY NEW LINE INTO ARRAY B
230IF(A(4)=135)OR(A(4)=145)THEN340\IFA(4)=143THEN150\GOTO320
240IFA(4)<>143THEN330
250!"LINE",D," CONTAINS REMARK NOT REMOVED"\GOTO340
320GOSUB470\GOTO150
330GOSUB510\GOSUB470\GOTO150
340GOSUB510\GOSUB540\GOTO150
350!"PROGRAM NOT ON DISK #1"\GOTO50
360!F$," NOT PROGRAM FILE"\GOTO50
370GOSUB510\FORJ=2TO132\A(J)=0\NEXT
380FORJ=0TO132\WRITE#1,$A(J)\NEXT
390CLOSE#0\CLOSE#1\END
400IFZ=1THENZ=0ELSEZ=1\RETURN
410REM SUBROUTINE TO SAVE LINE # REFERENCES
420READ#0,$C,$D\I=I+2\L8=C+D*256
430IFL9=0THEN450\FORI1=0TOL9-1
440IFL(L9)=L8THENEXIT460\NEXT
450L(L9)=L8\L9=L9+1\RETURN
460RETURN
470IFB1<5THEN480\B(B1)=92\B1=B1+1
480FORI=B2TOB-1\B(B1)=A(I)\B1=B1+1\NEXT
490B2=4
500RETURN
510IFB1=0THENRETURN\B(1)=B1
520FORI=N0TOB1-1\WRITE#1,$B(I)\NEXT
530B2=0\B1=0\N0=0\RETURN
540A(1)=B
550FORN=N0TOB-1\WRITE#1,$A(N)\NEXT
560N0=0\RETURN
1000A(2)=C(2)\A(3)=C(3)\B9=4
1010FORN=4TOB-1\IFC(N)=34THENGOSUB400
1020IF(C(N)=32)AND(Z=0)AND(B>=N)THEN1050
1030B9=B9+1\A(B9-1)=C(N)
1040IFC(N)=143THENEXIT1070
1050NEXT\B=B9\RETURN
1060REM STATEMENT CONTAINS REMARK
1070IFA(4)=143THEN1100
1080B=B9-2\RETURN
1100FORT0=N+1TOB-1\B9=B9+1\A(B9-1)=C(T0)\NEXT\B=B9\RETURN
```

Listing 1. Compressed version in North Star Basic.

David K. Gustafson is the data processing manager for Abrams Aerial Survey Corp., 124 N. Larch St., Lansing, MI 48901.



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Listing 2. List program.

```
10REM LISTPROG TO RUN ON N.STAR VERSION 4
20DIMA$(3)\A$=""\X9=1\X8=-1\N5=51\REM N5 = LINES PER PAGE ON PRINTER (TTY43=51)
30IFFILE("X-REF")=-1THENCREATE"X-REF",50\OPEN#1,"X-REF"
40INPUT"OUTPUT DEVICE ",U\IFU=4THEN40\LINE#U,132\N=N5\N0=1
50INPUT"PROGRAM TO LIST ",F$\WRITE#1,U,N5,F$\IFFILE(F$)=-1THEN60ELSE80
60IFFILE(F$+",2")=-1THEN1340
70IFFILE(F$+",2")<>2THEN1350ELSE100
80IFFILE(F$)<>2THEN1350
90GOSUB1290\OPEN#0%FILE(F$),F$,L\GOSUB1250\GOTO110
100GOSUB1290\OPEN#0%FILE(F$+",2"),F$+",2",L\GOSUB1250
110FORI=1TO256*L\READ #0,&A\GOSUB130\NEXT\!#U
120CLOSE#0\GOSUB1280\END
130IFA=13THEN1250
140IFA<32THENRETURN
150IFA=92THEN1230
160IF(A>31)AND(A<128)THEN170\IFZ0=0THEN!#U," ",\GOSUB180\IFZ0=0THEN!#U," ",\RETURN
170!#U,CHR$(A),\IFA=44THEN1410\IF(A=34)AND(Z0=0)THENGOSUB1390\IF(Z0=1)OR(V6=1)OR(A>90)OR(A=41)THENRETURNELSE1400
180IFA<128THENRETURN\GOSUB190\GOSUB1410\RETURN
190ONINT((A-128)/10)+1GOTO200,210,220,230,240,250,260,270,280,290,300,310,320
200ONA-127GOTO1110,590,620,610,520,770,1300,1140,780,790
210ONA-137GOTO890,900,1130,1000,1150,1030,810,820,630,800
220ONA-147GOTO1180,1160,1120,640,990,760,1260,330,830,340
230ONA-157GOTO350,360,370,380,390,400,410,430,440,450
240ONA-167GOTO460,470,480,490,500,510,530,540,600,650
250ONA-177GOTO420,980,570,1200,1040,1020,1050,550,1060,1100
260ONA-187GOTO1220,1220,1220,1220,1220,1220,1220,1220,710,1220
270ONA-197GOTO940,1220,1220,1220,930,670,1010,1090,1070,1220
280ONA-207GOTO1220,1220,730,1220,1220,1220,1220,1220,920,1190
290ONA-217GOTO1080,950,720,740,750,1170,910,1210,840,850
300ONA-227GOTO1220,860,1220,660,1220,1170,1220,1220,960,970
310ONA-237GOTO1220,700,690,680,1220,1220,870,580,880,560
320ONA-247GOTO1220,1220,1220,1220,1220,1220,1220,1220
330!#U,"CHAIN",\RETURN
340!#U,"DESTROY",\RETURN
350!#U,"CREATE",\RETURN
360!#U,"ERRSET",\RETURN
370!#U,"RUN",\RETURN
380!#U,"LIST",\RETURN
390!#U,"MEMSET",\RETURN
400!#U,"SCR",\RETURN
410!#U,"AUTO",\RETURN
420!#U,"THEN",\RETURN
430!#U,"LOAD",\RETURN
440!#U,"CONT",\RETURN
450!#U,"APPEND",\RETURN
460!#U,"REN",\RETURN
470!#U,"NSAVE",\RETURN
480!#U,"SAVE",\RETURN
490!#U,"BYE",\RETURN
500!#U,"EDIT",\RETURN
510!#U,"DEL",\RETURN
520!#U,"IF",\RETURN
530!#U,"PSIZE",\RETURN
540!#U,"CAT",\RETURN
550!#U,"NOENDMARK",\RETURN
560!#U,"NOT",\RETURN
570!#U,"ELSE",\RETURN
580!#U,"=",\RETURN
590!#U,"FOR",\RETURN
600!#U,"STEP",\RETURN
610!#U,"NEXT",\RETURN
620!#U,"PRINT",\RETURN
630!#U,"PRINT",\RETURN
640!#U,"OPEN",\RETURN
650!#U,"TO",\RETURN
660!#U,"/",\RETURN
670!#U,"SIN",\RETURN
680!#U,"<>",\RETURN
690!#U,"<=",\RETURN
700!#U,">=",\RETURN
710!#U,"SQRT",\RETURN
720!#U,"COS",\RETURN
730!#U,"ATN",\RETURN
740!#U,"LOG",\RETURN
750!#U,"EXP",\RETURN
760!#U,"WRITE",\RETURN
770!#U,"READ",\RETURN
780!#U,"GOTO",\RETURN
790!#U,"GOSUB",\RETURN
800!#U,"ON",\RETURN
810!#U,"FN",\V8=1\RETURN
820!#U,"DEF",\RETURN
830!#U,"LINE",\RETURN
840!#U,"*",\RETURN
850!#U,"+",\RETURN
860!#U,"-",\RETURN
870!#U,"<",\RETURN
880!#U,">",\RETURN
890!#U,"RETURN",\RETURN
900!#U,"DIM",\RETURN
910!#U,"(",\RETURN
920!#U,"FREE",\RETURN
930!#U,"SGN",\RETURN
940!#U,"INT",\RETURN
950!#U,"ABS",\RETURN
960!#U,"AND",\RETURN
970!#U,"OR",\RETURN
980!#U,"TAB",\V7=1\RETURN
990!#U,"CLOSE",\RETURN
1000!#U,"END",\RETURN
1010!#U,"LEN",\RETURN
1020!#U,"VAL",\RETURN
1030!#U,"REM",\Z0=1\RETURN
1040!#U,"ASC",\RETURN
1050!#U,"STR$",\RETURN
1060!#U,"INCHAR$",\RETURN
1070!#U,"RND",\RETURN
1080!#U,"EXAM",\RETURN
1090!#U,"CALL",\RETURN
1100!#U,"FILE",\RETURN
1110!#U,"LET",\RETURN
1120!#U,"EXIT",\RETURN
1130!#U,"STOP",\RETURN
1140!#U,"DATA",\RETURN
1150!#U,"RESTORE",\RETURN
1160!#U,"FILL",\RETURN
1170!#U,"TYP",\RETURN
1180!#U,"OUT",\RETURN
1190!#U,"INP",\RETURN
1200!#U,"CHR$",\RETURN
1210!#U,"^",\RETURN
1220RETURN
1230IFZ0=1THEN1240\!#U\N=N-1\GOSUB1260\!#U,TAB(10),": ",\GOSUB1410\RETURN
1240!#U,":",\RETURN
1250READ#0,&B,&C,&D\GOSUB1410\GOSUB1360\Z0=0\!#U\N=N-1\GOSUB1270\GOSUB1380\!#U,X0," ",\RETURN
1260READ#0,&B,&C\!#U,C*256+B,\GOSUB1410\RETURN
1270IFN>12THENRETURN\IFU<>0THENGOSUB1280\N=N5\GOSUB1290\RETURN
```

More

More

Listing 2 continued.

```
1280FORI0=NTO1STEP-1\!#U\NEXT\RETURN
1290!#U,TAB(25),"PROGRAM  ",F$,TAB(60),"PAGE",N0\!#U\N=N-2\N0=N0+1\RETURN
1300READ#0,&A\IFA<>49THEN1310\!#U,"INPUT1",\RETURN
1310!#U,"INPUT ",\GOTO130
1320!#U\!#U\!#U,U0," BYTES USED OUT OF",L*256," AVAILABLE"\N=N-5
1330!#U\!#U,"PERCENT USE OF PROGRAM FILE =",%5F1,(U0+1)/(L*256)*100,"%"\IFU<>0THENGOSUB1280\GOSUB1410\!%#,\CHAIN"SORT"\END
1340!"FILE ",F$," NOT IN EITHER DRIVE"\END
1350!"FILE ",F$," NOT PROGRAM FILE"\END
1360U0=U0+B\IFB=1THEN1320\RETURN
1370REM X0 = PRESENT LINE #
1380X0=D*256+C\RETURN
1390IFV6=0THENV6=1ELSEV6=0\RETURN
1400A$=A$+CHR$(A)\RETURN
1410IFA$=""THENRETURN\A$=A$+"    "\IFASC(A$)<65THEN1430\V5=1\IFA=224THENV5=2\IFA$(2,2)="$"THENV5=3\IFA$(3,3)="$"THENV5=3
1420IFV8=1THENV5=4\!%#6I,\WRITE#1,CHR$(V5)+A$+STR$(X0)
1430V8=0\A$=""\!%#,\RETURN
```

Listing 3. Variable cross-reference sort.

```
10REM SORT OF VARIABLES TAKEN FROM NORTH STAR DISK NSSE 2 (ALPHSORT)
20DIMA$(20),B$(20)
30 REM DEVICE # 'U', LINES PER PAGE FOR PRINTER 'N7' AND PROGRAM NAME 'F$' READ FROM DATA FILE
40OPEN#0,"X-REF"\READ#0,U,N7,F$\N8=N7\W=10\W1=W-1\DIMN$(1280*(W+1))
50N=N+1\P=1+(N-1)*W\IFTYP(0)=0THEN60\READ#0,N$(P,P+W1)\GOTO50
60N=N-1\!"SORTING..."\L9=INT(LOG(N)/LOG(2)+.9)\DIML(N+L9+2)\I=0\J=N+1
70L(1)=1\L(J)=1\K2=1\IFN<=1THEN230\S1=N
80IFS1<4THEN90\K2=K2*2\B2=S1/2\S1=INT(B2)\T4=T4+(B2-S1)*K2\GOTO80
90T4=K2-T4\B2=K2/2
100IFK1=K2THEN240\T1=K1+1\K1=K1+1\B1=B2\T3=T2
110T1=T1/2\IFINT(T1)<T1THEN120\M1=M1+1\T2=T2-B1\B1=B1/2\GOTO110
120T2=T2+B1\IFS1=2THEN130\IFT3<T4THEN140\M1=-M1\GOTO150
130IFT3<T4THEN140
140M1=M1+1
150I=I+1
160L1=I\L(I)=I\L(J)=I\L0=J\J=J+1\I=I+1\L2=I\L(I)=I\L(J)=I\GOTO180
170J=J-1\L0=J-1\L1=L(L0)\L2=L(J)
180P1=1+(L1-1)*W\P2=1+(L2-1)*W\IFN$(P1,P1+W1)<=N$(P2,P2+W1)THEN210\L(L0)=L2
190L0=L2\L2=L(L0)\IFL2=L0THEN220\P1=1+(L1-1)*W\P2=1+(L2-1)*W
200IFN$(P1,P1+W1)>N$(P2,P2+W1)THEN190\L(L0)=L1
210L0=L1\L1=L(L0)\IFL1<>L0THEN180\L(L0)=L2\GOTO230
220L(L0)=L1
230M1=M1-1\IFM1>0THEN170\IFM1=0THEN100\M1=1-M1\GOTO150
240GOSUB500
250L0=N+1
260I=1\L0=L(L0)\P=1+(L0-1)*W\GOSUB340
270FORI=2TON
280L0=L(L0)
290P=1+(L0-1)*W
300GOSUB360
310NEXTI
320!#U\!#U\!#U\N8=N8-3
330GOTO400
340A$=N$(P,P+3)\X=VAL(N$(P+4,P+W1))\IFASC(A$)<>N9THENGOSUB420
350!#U,A$(2),TAB(10),%6I,X,\N6=0\RETURN
360B$=N$(P,P+3)\IFB$="    "THENRETURN\Y=VAL(N$(P+4,P+W1))\IFASC(B$)<>N9THENGOSUB410
370IFB$=A$THEN380\A$=B$\X=Y\!#U\!#U\N8=N8-2\GOSUB480\GOTO350
380IFY=XTHENRETURN\!#U,%6I,Y,\X=Y\N6=N6+1\IFN6>=19THEN390\RETURN
390!#U\!#U,TAB(10),\N6=0\N8=N8-1\RETURN
400CLOSE#0\DESTROY"X-REF"\END
410N9=ASC(B$)\GOTO430
420N9=ASC(A$)
430ONN9GOTO440,450,460,470
440!#U,"VARIABLE",TAB(15),"LINE REFERENCES"\!#U\N8=N8-2\RETURN
450!#U\!#U\!#U\!#U,"ARRAY",TAB(15),"LINE REFERENCES"\N8=N8-4\RETURN
460!#U\!#U\!#U\!#U,"STRING",TAB(15),"LINE REFERENCES"\N8=N8-4\RETURN
470!#U\!#U\!#U\!#U,"USER FUNCTION",TAB(15),"LINE REFERENCES"\N8=N8-4\RETURN
480IFN8>10THENRETURN
490FORI9=N8TO1STEP-1\!#U\NEXT\N8=N7\GOSUB500\GOSUB420\RETURN
500!#U,TAB(30),"PROGRAM ",F$\!#U\N8=N8-2\RETURN
```

Example 1. Uncompressed program dump.

```
10 DIM T(16), H$(16)
20 REM H$ = HEX DIGIT ARRAY
30 READ H$
40 DATA "0123456789ABCDEF"
50 INPUT "PROGRAM TO DUMP ",F$
60 REM CHECK FOR CORRECT FILE TYPE
70 IF FILE(F$) <> 1 THEN 340
80 OPEN #0 %1,F$,L
```

Example 1 continues.

eliminated, the memory savings can be significant. The program will execute faster because there will be fewer lines to search and fewer characters to interpret.

The program in Listing 1 compresses a Basic program stored on disk, writing the compressed version as a separate file. The original program on disk drive 1 is left alone for future modifications, and the compressed version on drive 2 is available for execution after loading. The only requirement before compression is that the program be free of

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Example 1 continued.

```
90 FOR I=0 TO L*256-1 STEP 16
100 ! FNH0$( INT(I/256)), FNH0$(I- INT(I/256)*256),": ",
110 FOR I0=0 TO 15
120 READ #0,&A \ REM BYTE ACCESS OF PROGRAM FILE
130 GOSUB 200
140 NEXT I0
150 GOSUB 240
160 !
170 J = 0
180 NEXT I
190 END
200 J = J + 1
210 ! " ", FNH0$(A),
220 T(J) = A
230 RETURN
240 ! "      ",
250 FOR K=1 TO 16
260 IF (T(K)>=32) AND (T(K)<127) THEN ! CHR$(T(K)), ELSE ! ".",
270 NEXT K
280 RETURN
290 REM FUNCTION RETURNS VALUE AS TWO HEX DIGITS
300 DEF FNH0$(Z)
310 H0$ = H$(Z/16+1,Z/16+1) + H$(Z-INT(Z/16)*16+1,Z-INT(Z/16)*16+1)
320 RETURN H0$
330 FN END
340 ! "FILE NOT 'GO' FILE"
350 END
```

syntax errors. Do not compress the program until it is fully debugged, since no error checking is done while compressing.

The program in Listing 2 will list the compressed version in a form that is easy to read and understand. This program also sets up a cross-reference file for variables.

The program in Listing 3 sorts the cross-reference file and prints a cross-reference to program variables. This program uses a modified version of the fast Woodruff sort which I found on North Star Users Group disk NSSE-2. This sorting technique sets up a separate link array instead of exchanging values to be sorted. Link addresses are placed in this array as values are sorted, and upon completion of the sort the values are printed by following the links in this array.

Programs 2 and 3 are chained together and form a set. Data is passed in disk file "X-REF" and the output device number is placed in memory location 0. Variable N5 on line 20 of program 2 and variable N7 on line 30 of program 3 define the number of lines per page of the output printer so that the output can be paged correctly. Printed output is expanded to a maximum of 132 columns.

```
10DIMT(16),H$(16)\READH$
40DATA"0123456789ABCDEF"
50INPUT"PROGRAM TO DUMP ",F$\IFFILE(F$)<>1THEN340\OPENH0%1,F$,L\FORI=0TOL*256-1STEP16\!FNH0$(INT(I/256)),FNH0$(I-INT(I/256)*256),":
",\FORI0=0TO15\READH0,&A\GOSUB200\NEXTI0\GOSUB240\!\J=0\NEXTI\END
200J=J+1\!" ",FNH0$(A),\T(J)=A\RETURN
240!"      ",\FORK=1TO16\IF(T(K)>=32)AND(T(K)<127)THEN!CHR$(T(K)),ELSE!".",\NEXTK\RETURN
300DEFFNH0$(Z)
310H0$=H$(Z/16+1,Z/16+1)+H$(Z-INT(Z/16)*16+1,Z-INT(Z/16)*16+1)\RETURNH0$\FNEND
340!"FILE NOT 'GO' FILE"\END
```

Example 2. Compressed program dump.

```
10  DIM T ( 16),H$ ( 16)
        :  READ H$
40  DATA "0123456789ABCDEF"
50  INPUT " PROGRAM TO DUMP ",F$
        :  IF  FILE  ( F$) <> 1 THEN   340
        :  OPEN H0%1,F$,L
        :  FOR I = 0 TO L * 256 - 1 STEP 16
        :  PRINT  FN H0$ (  INT  ( I / 256)), FN H0$ ( I -  INT  ( I / 256) * 256),": ",
        :  FOR I0 = 0 TO 15
        :  READ H0,&A
        :  GOSUB  200
        :  NEXT I0
        :  GOSUB   240
        :  PRINT
        : J = 0
        :  NEXT I
        :  END
200 J = J + 1
        :  PRINT " ", FN H0$ ( A),
        : T ( J) = A
        :  RETURN
240  PRINT "      ",
        :  FOR K = 1 TO 16
        :  IF  ( T ( K) >= 32) AND  ( T ( K) < 127) THEN  PRINT  CHR$  ( T ( K)), ELSE  PRINT ".",
        :  NEXT K
        :  RETURN
300  DEF  FN H0$ ( Z)
310 H0$ = H$ ( Z / 16 + 1,Z / 16 + 1) + H$ ( Z -  INT  ( Z / 16) * 16 + 1,Z -  INT  ( Z / 16) * 16 + 1)
        :  RETURN H0$
        :  FN  END
340  PRINT "FILE NOT 'GO' FILE"
        :  END

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```

Example 3. Example 2 compressed.

The three examples show a typical Basic program; in this case, a file dump program to output a machine-language Go file to the printer in hexadecimal format and ASCII. Example 1 is the dump program in original form. Example 2 is the same program compressed, and Example 3 is the compressed version listed from disk using the listing program, and includes the cross-reference to variables.

This set of programs works on North Star Basic programs written in version 4 or later Basic, but an enterprising individual could modify them for use on any disk Basic which has byte access to disk files.■

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5	LEASEINT	Interest rate on lease
6	BREAKEVN	Breakeven analysis
7	DEPRSL	Straightline depreciation
8	DEPRSY	Sum of the digits depreciation
9	DEPRDB	Declining balance depreciation
10	DEPRDDB	Double declining balance depreciation
11	TAXDEP	Cash flow vs. depreciation tables
12	CHECK2	Prints NEBS checks along with daily register
13	CHECKBK1	Checkbook maintenance program
14	MORTGAGE/A	Mortgage amortization table
15	MULTMON	Computes time needed for money to double, triple, etc.
16	SALVAGE	Determines salvage value of an investment
17	RRVARIN	Rate of return on investment with variable inflows
18	RRCONST	Rate of return on investment with constant inflows
19	EFFECT	Effective interest rate of a loan
20	FVAL	Future value of an investment (compound interest)
21	PVAL	Present value of a future amount
22	LOANPAY	Amount of payment on a loan
23	REGWITH	Equal withdrawals from investment to leave 0 over
24	SIMPDISK	Simple discount analysis
25	DATEVAL	Equivalent & nonequivalent dated values for oblig.
26	ANNUDEF	Present value of deferred annuities
27	MARKUP	% Markup analysis for items
28	SINKFUND	Sinking fund amortization program
29	BONDVAL	Value of a bond
30	DEPLETE	Depletion analysis
31	BLACKSH	Black Scholes options analysis
32	STOCVAL1	Expected return on stock via discounts dividends
33	WARVAL	Value of a warrant
34	BONDVAL2	Value of a bond
35	EPSEST	Estimate of future earnings per share for company
36	BETAALPH	Computes alpha and beta variables for stock
37	SHARPE1	Portfolio selection model-i.e. what stocks to hold
38	OPTWRITE	Option writing computations
39	RTVAL	Value of a right
40	EXPVAL	Expected value analysis
41	BAYES	Bayesian decisions
42	VALPRINF	Value of perfect information
43	VALADINF	Value of additional information
44	UTILITY	Derives utility function
45	SIMPLEX	Linear programming solution by simplex method
46	TRANS	Transportation method for linear programming
47	EOQ	Economic order quantity inventory model
48	QUEUE1	Single server queueing (waiting line) model
49	CVP	Cost-volume-profit analysis
50	CONDPROF	Conditional profit tables
51	OPTLOSS	Opportunity loss tables
52	FQUOQ	Fixed quantity economic order quantity model
53	FQEOWSH	As above but with shortages permitted
54	FQEOQPB	As above but with quantity price breaks
55	QUEUECB	Cost-benefit waiting line analysis
56	NCFANAL	Net cash-flow analysis for simple investment
57	PROFIND	Profitability index of a project
58	CAP1	Cap. Asset Pr. Model analysis of project
59	WACC	Weighted average cost of capital
60	COMPBAL	True rate on loan with compensating bal. required
61	DISCBAL	True rate on discounted loan
62	MERGANAL	Merger analysis computations
63	FINRAT	Financial ratios for a firm
64	NPV	Net present value of project
65	PRINDLAS	Laspeyres price index
66	PRINDPA	Paasche price index
67	SEASIND	Constructs seasonal quantity indices for company
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69	TIMEMOV	Time series analysis moving average trend
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72	LETWRT	Letter writing system-links with MAILPAC
73	SORT3	Sorts list of names
74	LABEL1	Shipping label maker
75	LABEL2	Name label maker
76	BUSBUD	DOME business bookkeeping system
77	TIMECLCK	Computes weeks total hours from timeclock info.
78	ACCTPAY	In memory accounts payable system-storage permitted
79	INVOICE	Generate invoice on screen and print on printer
80	INVENT2	In memory inventory control system
81	TELDIR	Computerized telephone directory
82	TIMUSAN	Time use analysis
83	ASSIGN	Use of assignment algorithm for optimal job assign.
84	ACCTREC	In memory accounts receivable system-storage ok
85	TERMSPAY	Compares 3 methods of repayment of loans
86	PAYNET	Computes gross pay required for given net
87	SELLPR	Computes selling price for given after tax amount
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Take your lead from this author, who developed an appropriate Pascal mechanism for tone generation on the C8P, and overcome the special problems of writing I/O interfaces in Pascal.

Pascal I/O Interfacing Made Easy

By Marc Stiegler

Structured languages such as Pascal are designed to maintain module integrity at all costs. This protection has many advantages: it prevents the programmer from clobbering modules, it prevents the modules from clobbering each other and it prevents the modules from clobbering the programmer. Since this modularity also separates the programmer from the hardware, it's easier for the application programmer to work without worrying about which hardware configuration he happened to be stuck with on an odd Tuesday.

However, this ease-of-use for applications has a penalty—it leaves a heavy burden on the systems programmer to build good, high-level I/O interfaces. And for writing such interfaces, the modular protection from hardware means that Pascal will fight him every step of the way (this may be one of the reasons that personal computer owners, who must do their own systems work, find Pascal to be more pain than purity). Consequently, the systems programmer may be forced to large-scale use of assembly code.

With memory-mapped I/O, however, writing the interfaces is quite easy. Take, for example, this mechanism for tone generation on the OSI C8P.

Memory-mapped I/O refers to computers in which all the peripheral devices are assigned specific memory locations. The processor writes to and reads from these locations just like any other locations; only the peripheral devices know that they're there. Consequently, all primitive I/O can be done by the Basic POKE and PEEK statements.

Address correspondence to Marc Stiegler, 132 Laurel Way, Apt. 2B, Herndon, VA 22070.

Listing 1. POKE and PEEK procedures in Pascal.

```
;*****************************
;* THIS SOURCE CONTAINS 2 SUBROUTINES:
;*
;* PROCEDURE POKEHI(LOCATION,VALUE:INTEGER)
;*     AND
;* FUNCTION PEEKHI(LOCATION:INTEGER):INTEGER
;*
;* THE VALUE PASSED TO POKEHI IS
;* ASSUMED TO BE IN RANGE 0..255,
;* AND PEEKHI RETURNS A VALUE
;* IN RANGE 0..255
;* IN BOTH SUBROUTINES, THE LOCATION
;* SHOULD BE IN RANGE 0..32767.  THE
;* SUBROUTINES ALWAYS ADD 32768 TO THE
;* LOCATION, SO THEY ACCESS THE TOP
;* HALF OF MEMORY.
;*****************************
.PROC    POKEHI,2
;**STORE RETURN ADDRESS
PLA
STA      RETURN
PLA
STA      RETURN+1
;**GET SIGNIFICANT BYTE OF INTEGER
PLA
TAY
PLA      ;THROW SECOND HALF OF INTEGER AWAY
;**STORE MEMORY LOCATION FOR POKING ON ZERO PAGE
PLA
STA      51H
```

More →

The Programs

It is possible to write POKE and PEEK statements for Pascal; in fact, there are several methods for doing so. Listing 1 shows a variant on POKE and PEEK which can be written using the UCSD assembler. Since most of the interesting I/O locations are found in the top 32K of RAM, and since a normal integer in Pascal can only go up to 32767, the procedure POKEHI adds 32768 to the location passed to it (by flipping the left-most bit). Thus, to put a 1 in location 43879, you would invoke POKEHI(11111,1).

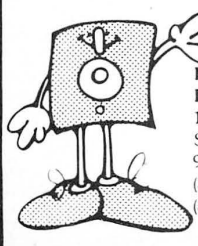
In a sense, POKEHI and PEEKHI solve all the problems with I/O, at least as well as they can be solved in Basic. However, Pascal can do better. The POKEHI statement is as dangerous as it is powerful—there are only a handful of locations you would ever really want to POKE to, but there are now almost 32K locations you can POKE by accident as well. Thus, you want to channel the use of poking to productive purposes. You do this by building a UCSD library package, called a UNIT. The UNIT SOUND is

Program continued.

```
        PLA
        CLC     ;ADD 2**15 SO RIGHT ADDRESS FOUND
        ADC     #80H
        STA     52H
        LDX     #0      ;GET 0 FOR ADDRESSING,PUT INTEGER IN
        TYA             ;REGISTER A
        STA     @51H,X  ;POKE THE INTEGER
        ;**GET BACK RETURN ADDRESS
        LDA     RETURN+1
        PHA
        LDA     RETURN
        PHA
        RTS
RETURN  .WORD
        ;*****************************
        .FUNC   PEEKHI,1
        ;**STORE RETURN ADDRESS
        PLA
        STA     RETURN
        PLA
        STA     RETURN+1
        ;**THROW OUT 2 DEAD WORDS
        ;**  (THESE DEAD BYTES ARE PASSED IN PASCAL
        ;**   FOR EVERY FUNCTION CALL)
        PLA
        PLA
        PLA
        PLA
        ;**STORE MEMORY LOCATION FOR PEEKING ON ZERO PAGE
        PLA
        STA     51H
        PLA
        CLC     ;ADD 2**15 SO RIGHT ADDRESS FOUND
        ADC     #80H
        STA     52H
        LDX     #0      ;GET 0 FOR ADDRESSING
        LDA     @51H,X  ;PEEK, GETTING VALUE IN REGISTER A
        TAY     ;PUSH 0 FOR MSB OF INTEGER IN RETURN
        LDA     #0
        PHA
        TYA     ;PUSH INTEGER
        PHA
        ;**GET BACK RETURN ADDRESS
        LDA     RETURN+1
        PHA
        LDA     RETURN
        PHA
        RTS
RETURN  .WORD
        .END
```


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displayed in Listing 2. A sample of how you would use the sound is shown in Listing 3. [Note that this program will compile correctly only if the UNIT SOUND and the POKEHI assembly code have been added to the system library; otherwise, the {*$U filename*} compiler command must be placed before the statement USES SOUND so the compiler knows where to look for the interface specifications.]

Finally, one marvelous side benefit of using UNITs is that, once the UNITs are written, you can forget about how to write them. Never again will you wind up digging through manuals trying to remember the memory locations you POKE or PEEK to for I/O.■

```
PROGRAM SIMPLE_MUSIC;
USES SOUND;
VAR NOTE:TONE;

PROCEDURE PAUSE;
VAR I,J:INTEGER;
BEGIN
FOR I:=1 TO 100 DO
   J:=1;
END;

BEGIN
SOUND_ON;
FOR NOTE:=1 TO 255 DO
   BEGIN
   MAKE_MUSIC(NOTE);
   PAUSE;
   END;
SOUND_OFF;
END.
```

Listing 3. Using UNIT SOUND.

```
(*$S+*)  (*SWAP OPTION MUST BE ON TO COMPILE UNITS*)
(*$R-*)
UNIT SOUND;

INTERFACE
   TYPE TONE=1..255;

   PROCEDURE SOUND_ON;
   PROCEDURE SOUND_OFF;
   PROCEDURE MAKE_MUSIC(NOTE:TONE);

IMPLEMENTATION

CONST ON_OFF_PORT=24064;

PROCEDURE POKEHI(LOCATION,VALUE:INTEGER);
TYPE TWO_CASES=(INT,POINT);
     SMALL_INT=0..255;
     BOOL_ARRAY=PACKED ARRAY[0..1] OF SMALL_INT;
     ADDRESSES=RECORD
               CASE TWO_CASES OF
               INT:(VALUE:INTEGER);
               POINT:(POINTER:^BOOL_ARRAY);
               END;
VAR ADDRESS:ADDRESSES;
BEGIN
ADDRESS.VALUE:=LOCATION+32765+3;
ADDRESS.POINTER^[0]:=VALUE;
END;

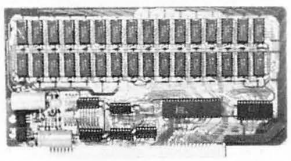
PROCEDURE SOUND_ON;
(*THIS PROCEDURE ASSUMES THE MONITOR IS
  SET TO 64 CHARACTER LINES ON A B&W MONITOR*)
CONST ON=3;
BEGIN
POKEHI(ON_OFF_PORT,ON);
END;
PROCEDURE SOUND_OFF;
(*THIS PROCEDURE ASSUMES THE MONITOR IS
  SET TO 64 CHARACTER LINES ON A B&W MONITOR*)
CONST OFF=1;
BEGIN
POKEHI(ON_OFF_PORT,OFF);
END;
PROCEDURE MAKE_MUSIC;
CONST MUSIC_PORT=24321;
BEGIN
POKEHI(MUSIC_PORT,NOTE);
END;

END.
```

Listing 2. Channeling POKE statements with the UNIT SOUND.

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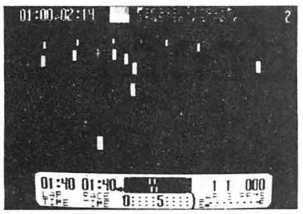
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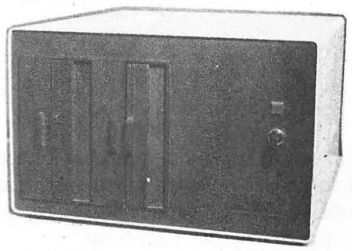
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It's no hocus-pocus. Even in Basic, the Sorcerer can display reverse video with the help of a machine-language subroutine.

Reverse Video For the Sorcerer

By Dwayne E. Smith

I'm sure that some of you Sorcerer users (and some of you with memory-mapped video boards) would like to be able to print reverse video on screen. For the Sorcerer, it's easy. All it takes is a short machine-language subroutine that can be used from Basic or other languages that can call a machine-language program.

After reading Charles Strom's article about using WordStar with the Sorcerer computer (April 1981, pp.180–182), in which he mentions that he produced reverse video, I decided that I wanted to use reverse video for VEDIT. The VEDIT text editor can use reverse video for the status line and the cursor. For more about VEDIT, see Gene Head's review (May 1981, pp. 50–51). Before we look at the subroutine, let's see how the Sorcerer's video works.

Sorcerer Video

With memory-mapped video, each location for each character on the screen is addressed as memory. Video boards of this type commonly display 64 characters and 16 lines of text, which is very convenient since this uses 1K bytes of memory. The Sorcerer, on the other hand, displays 64 characters and 30 lines of text (1920 bytes).

To print a character, the ASCII (American Standard Code of Information Interchange) value of the character needed must be placed into the appropriate byte of memory. Say, for example, that you want to place the character A at the four corners of the screen. The Sorcerer's screen RAM begins at F080H, which is the

```
EXIDY Z-80 ASSEMBLER
   ADDR  OBJECT    ST #

                   0001
                   0002 ;        REVERSE VIDEO SUBROUTINE
                   0003 ;              FOR THE
                   0004 ;      E X I D Y   S O R C E R E R
                   0005
                   0006
                   0007
                   0008          ;EQUATES
                   0009
   >F800           0010 CHARST   EQU     0F800H  ;LOC. OF ASCII
   >FC00           0011 CHARPT   EQU     0FC00H  ;LOC. OF GRAPHICS
   >0400           0012 COUNT    EQU     CHARPT-CHARST   ;NO. OF
                   0013                          ;CHARS. TO MOVE
                   0014
                   0015
                   0016 ;COPY THE ASCII CHARS. INTO GRAPHICS AREA
                   0017
   '0000  2100F8   0018 REVID    LD      HL,CHARST       ;LOAD POINTERS
   '0003  1100FC   0019          LD      DE,CHARPT
   '0006  010004   0020          LD      BC,COUNT        ;LOAD LOOP
                   0021                          ;COUNTER
   '0009  EDB0     0022          LDIR            ;COPY ASCII INTO
                   0023                          ;GRAPHICS AREA
                   0024
                   0025
                   0026 ;COMPLEMENT EACH BYTE IN THE GRAPHICS AREA
                   0027
   '000B  2100FC   0028          LD      HL,CHARPT       ;LOAD POINTER
   '000E  010004   0029          LD      BC,COUNT        ;LOAD LOOP
                   0030                          ;COUNTER
   '0011  7E       0031 LOOP     LD      A,(HL)  ;GET A CHAR.
   '0012  2F       0032          CPL             ;REVERSE BITS
   '0013  77       0033          LD      (HL),A  ;PUT IT BACK
   '0014  23       0034          INC     HL      ;ADVANCE POINTER
   '0015  0B       0035          DEC     BC      ;COUNT ONE CHAR DONE
   '0016  97       0036          SUB     A       ;CLEAR A REG.
   '0017  B0       0037          OR      B       ;IS B REG. ZERO?
   '0018  20F7     0038          JR      NZ,LOOP-$       ;NO, DO AGAIN
   '001A  97       0039          SUB     A       ;YES, CLEAR A REG.
   '001B  B1       0040          OR      C       ;IS C REG. ZERO?
   '001C  20F3     0041          JR      NZ,LOOP-$       ;NO, DO AGAIN
   '001E  C9       0042          RET             ;YES, WE'RE DONE!!
                   0043
                   0044 ;END
ERRORS=0000

CHARPT      FC00 CHARST      F800 COUNT       0400
LOOP        0011 REVID       0000
```

Listing 1.

Address correspondence to Dwayne E. Smith, 2949 Ulloa St., San Francisco, CA 94116.

upper left corner. The top-right corner is at F0BFH, the bottom-left at F7C0H, and the bottom-right corner (which is the end of screen RAM) is F7FFH. The ASCII number for A is 41H. If 41H is placed into the four previously-mentioned addresses, you'll see an A in each of the corners of your screen.

If you work only in Basic, you'll need to use the twos-complement form of the addresses since you can't poke anywhere above 32767 (7FFFH). For you, the corners of the screen are −3968 and −3905 for the top left and right, and −2112 and −2049 for the bottom left and right.

Each character (alphanumeric, graphic or user-defined) is printed on the screen as an 8×8 array of pixels (dots). Each pixel can be on (lit) or off (dark). The shape of the characters depends on which of these dots are on and off.

Each row of data is stored in a byte of memory. A 0 bit means that its pixel is off; a 1 means that it's on. It takes eight bytes to construct a character. If, for example, you want a solid block character, all of the bits must be on in memory (FFH or 255 decimal) at that character's location (see Fig. 1).

The Sorcerer can address 256 characters. The 128 standard ASCII character set is stored in a PROM at addresses F800H to FBFFH. That leaves another 128 characters. The 64 graphics symbols, pictured above the letters on the keyboard, are written into RAM addresses FC00H to FDFFH. The other 64 characters are the user-programmable set located at addresses FE00H to FFFFH. Since the set of graphics symbols is stored in RAM, the whole graphics area from FC00H to FFFFH is programmable.

		HEX	DECIMAL
FE00	X X X X X X X X	FF	255
FE01	X X X X X X X X	FF	255
FE02	X X X X X X X X	FF	255
FE03	X X X X X X X X	FF	255
FE04	X X X X X X X X	FF	255
FE05	X X X X X X X X	FF	255
FE06	X X X X X X X X	FF	255
FE07	X X X X X X X X	FF	255

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Fig. 1.

Reverse Video

A common way of producing reverse video is to use bit 7 (the most significant bit) of the character set to determine whether it is normal or reverse. For example, a space character is black in normal video. Its ASCII number is 20H. The reverse video space character is an all-white block. Its ASCII number is A0H (A0H = 10100000 binary = 20H [00100000B] + 80H [10000000B]). As you can see, when the most significant bit is on, the reverse video space character is addressed.

To do the same with the Sorcerer, you must first move the ASCII character set into the graphics memory area. You can then complement each byte. This means that the status of each bit is switched. All of the bits that are on are turned off, and vice versa. In this way you create the reverse image of the characters (light becomes dark, and dark become light).

I have included two listings of the assembly-language subroutine (Listings 1 and 2). Listing 1 was assembled with the Sorcerer Development Pac in Z-80 assembly language. Listing 2 was done with the CP/M assembler ASM. The subroutine is short enough that those of you without an assembler can enter the machine code without trouble. Those of you with CP/M may wish to store Listing 2 on disk so that you have the source code handy.

If you are familiar with 8080 assembly language, you may have noticed the relative jump instructions, which are not included in the 8080 instruction set. Since the Sorcerer uses a Z-80 microprocessor, these instructions may be used, and are

Listing 2.

```
*********************************************************
*                                                       *
*                                                       *
*              REVERSE VIDEO SUBROUTINE                 *
*                      for the                          *
*              E X I D Y   S O R C E R E R              *
*                                                       *
*                                                       *
*********************************************************


*********************************************************
*                                                       *
**********************   NOTES   **********************
*                                                       *
*                                                       *
*    The 128 standard ASCII characters located in PROM  *
*    (F800H - FBFFH) are copied into the programmable   *
*    graphics area (FC00H - FFFFH). Each bit in the     *
*    graphics area is then complemented, so that bits   *
*    normally on are off, and vice versa. Please note   *
*    that the form feed character (control - L) will    *
*    rewrite the Sorcerer's standard graphics into lo-  *
*    cations FC00H - FDFFH.                             *
*                                                       *
*********************************************************


*********************************************************
*                                                       *
*************   Z-80  INSTRUCTION EQUATES   *************
*                                                       *
*                  +------------------------+           *
B0ED =      LDIR:   EQU     0B0EDH  ;Z-80 LDIR instruction (EDB0H)  *
*                                   ; in reverse notation           *
*                                                                   *
0020 =      JRNZ:   EQU     20H     ;Z-80 JRNZ instruction          *
*                                                                   *
*********************************************************
*                                                       *
*************   LOCATION AND COUNT EQUATES   ************
*                                                       *
*                  +------------------------+           *
F800 =      CHARST: EQU     0F800H  ;Location of alphanumeric       *
*                                   ; charcter area                 *
*                                                                   *
```

More →

Listing 2 continued.

```
FC00 =          CHARPT: EQU     0FC00H  ;Location of graphics          *
                *                       ; character area               *
                *                                                      *
0400 =          COUNT:  EQU     CHARPT - CHARST ;Number of characters  *
                *                               ; to move              *
                *                                                      *
                ********************************************************

                ********************************************************
                *                                                      *
                *  Now we move the standard ASCII characters into the  *
                *  graphics memory area.                               *
                *                                                      *
                *                    +---------------+                 *
                *                                                      *
0100                    ORG     100H            ;This subroutine may be *
                *                               ; be placed anywhere in *
                *                               ; the TPA.             *
                *                                                      *
                *                                                      *
0100 2100FB     REVIDEO:LXI     H,CHARST        ;Load pointer to the    *
                *                               ; character location.  *
                *                                                      *
0103 1100FC             LXI     D,CHARPT        ;Load pointer to the    *
                *                               ; graphics location.   *
                *                                                      *
0106 010004             LXI     B,COUNT         ;Loop counter stores    *
                *                               ; the number of char-  *
                *                               ; acters to be moved.  *
                *                                                      *
0109 EDB0               DW      LDIR            ;Copy ASCII characters  *
                *                               ; in the graphics loc. *
                *                                                      *
                ********************************************************

                ********************************************************
                *                                                      *
                * Now that we have the ASCII where we want them, we    *
                * reverse the bits in each character, thereby producing *
                *                   REVERSE VIDEO!!                    *
                *                                                      *
                *                  +---------------------+             *
                *                                                      *
010B 2100FC             LXI     H,CHARPT        ;Load the pointer to    *
                *                               ; the graphics loca-   *
                *                               ; tion.                *
                *                                                      *
010E 010004             LXI     B,COUNT         ;Loop counter stores    *
                *                               ; the number of char-  *
                *                               ; acters.              *
                *                                                      *
0111 =          LOOP:   EQU     $               ;                       *
0111 7E                 MOV     A,M             ;Get a character,       *
0112 2F                 CMA                     ;reverse its bits,      *
0113 77                 MOV     M,A             ;and put it back.       *
0114 23                 INX     H               ;Point to next char.,   *
0115 0B                 DCX     B               ;count one char. done.  *
0116 97                 SUB     A               ;Clear A register.      *
0117 B0                 ORA     B               ;Is B reg. zero?        *
0118 20F7               DB      JRNZ,LOOP-$+0FFH    ;No - keep looping. *
011A 97                 SUB     A               ;Clear A register.      *
011B B1                 ORA     C               ;Is C reg. zero?        *
011C 20F3               DB      JRNZ,LOOP-$+0FFH    ;No - keep looping. *
011E C9                 RET                     ;Yes, we're done!!      *
                *                                                      *
                ********************************************************

011F                    END
```

Listing 3.

```
10 REM
20 REM
30 REM          SORCERER REVERSE VIDEO PRINTING
40 REM               DEMONSTRATION PROGRAM
50 REM
60 REM                by Dwayne E. Smith
70 REM
80 REM
90 REM    This program may be used to see the use of the
100 REM   reverse video machine language subroutine in
110 REM   Exidy's Standard BASIC. The machine language sub-
120 REM   routine is POKE'd into memory by this program,
130 REM   and is called using the USR(X) command.
140 REM
150 REM ==========================================================
160 REM
170 PRINT CHR$(12):REM  CLEAR THE SCREEN BEFORE CALLING RE-
```

More

produced by using the DB (define a byte) directive. In an equate statement, I set JRNZ (jump relative if nonzero) equal to 20H. This is the Z-80 code for this instruction. To get the displacement, I used a formula found in Vista's "Tech. Notes" section of the V200 disk system manual. To jump forward, use "address-$-1"; to jump backwards, use "address-$+0FFH". *This method will not give an error message if the jump is too far for the computation,* but it is useful in many instances.

Demonstration

I have included two demonstration programs. The first (Listing 3) uses the Sorcerer's Standard Basic; the second (Listing 4) is in CBasic-2. Both of these programs take input from the keyboard, and print it in both normal and reverse video. Both of these programs load the machine-language subroutine into memory, but in very different ways.

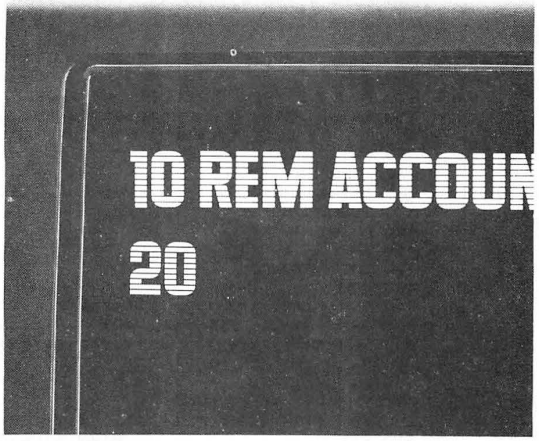
The Standard Basic program stores the subroutine in the form of data statements. The program is poked into memory, where it can be called using the USR(X) function. The location of the subroutine must be poked into a jump instruction. That's why we poke 0 into addresses 260 (low part of address) and 261 (high part of address). This will cause Basic to jump to the machine-language subroutine at 0000H. For more information about the USR(X) function, see the *Sorcerer Software Manual,* or the *Sorcerer Technical Manual* (#DP5003).

CBasic2 can load the subroutine directly from the disk. I have named the subroutine REVIDEO.COM, but the name can be different as long as the name in the disk directory and the program are the same. The SAVEMEM X,NAME instruction saves X bytes of memory for a machine-language program called Name, and then loads Name into memory. I have found that a variable cannot be used for X. An integer in either decimal or hexadecimal notation must be used.

To find the beginning address of Name, use the address in bytes 6 and 7 (which will be in the usual reverse notation), minus the value used as X. For example, in my 48K system, these bytes contain the address AA06H. Since the program in Listing 4 saves 80H bytes, the address of the subroutine REVIDEO.COM is AA06H – 80H = A986H.

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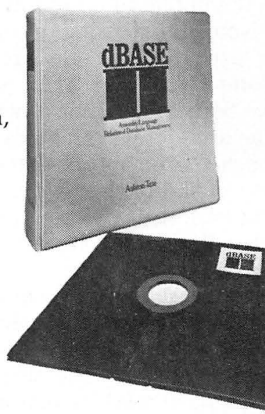
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(Dynamic Debugging Tool) to dump the memory for the address in bytes 6 and 7. DDT changes these values. The way that I found these values was to bring up the CP/M, reset, then dump the memory using the Monitor's DU command. This was done using a Vista V200 E-20 disk system. The technique may or may not work with other disk systems.

To print a string in reverse video, both programs follow the same procedure. The MID$ function is used to pick out each character in the string from left to right. The chosen character is changed into its ASCII number by the ASC function. The most significant bit (bit 7) is turned on by adding 80H or 128 decimal to the number (or by using the logical OR). The CHR$ function then converts this new number into its character equivalent.

Special Considerations

Some of you who try these programs may notice that the reverse characters don't look very good, or may even be illegible. I have found that the settings of your video monitor are very important. My monitor is an Amdek Video 100G, which has a signal control in the rear. This control can be varied to compensate for the strength of the input signal. If this control is set too high, the lit dots can bleed over into the dark spaces, causing characters such as (,), <, >, !, and # to almost disappear. Other monitors may have similar controls.

CP/M users may wish to place the reverse video routine in their CBIOS (customized basic input/output system). Because I wished to use reverse video with VEDIT, I had to include this routine as part of the disk operating system. I found that this routine (after omitting the RET instruction at the end) could be placed in the initialization routine.

Note that pressing the clear button or executing the clear-screen command PRINT CHR$(12) will rewrite the Sorcerer graphics into memory. The user-defined graphics will be untouched. This means that only a portion of the reverse video characters will be lost, but to rewrite them the subroutine must be executed once again.

The reason for the character loss is simple. The video screen is initialized by the Sorcerer's Monitor program every time the clear button is pressed, a reset is performed or a PRINT CHR$(12) command is given.

Listing 3 continued.

```
180 REM                    VERSE VIDEO SUBROUTINE.
190 FOR Q=0 TO 30
200 READ W
210 POKE Q,W:REM  POKE SUBROUTINE INTO BEGINNING OF MEMORY
220 NEXT Q
230 REM
240 REM        REVERSE VIDEO MACHINE LANGUAGE PROGRAM
250 REM
260 DATA 33,0,248,17,0,252,1,0
270 DATA 4,237,176,33,0,252,1,0
280 DATA 4,126,47,119,35,11,151,176
290 DATA 32,247,151,177,32,243,201
300 REM
310 POKE 260,0:POKE 261,0:REM  LOCATION OF SUBROUTINE IS
320 REM                        0000 HEX
330 Z=USR(Z):REM  EXECUTE THE SUBROUTINE
340 PRINT"Enter some characters and hit the RETURN key. To"
350 PRINT"quit, type the ESC key, then the RETURN key."
360 PRINT:PRINT
370 INPUT A$
380 IF A$=CHR$(27) THEN END:REM  QUIT IF ESC KEY IS TYPED.
390 GOSUB 480
400 PRINT A$,X$
410 PRINT
420 GOTO 370
430 REM
440 REM ************************************************************
450 REM          REVERSE VIDEO PRINTING SUBROUTINE
460 REM ************************************************************
470 REM
480 X$=""
490 FOR Q=1 TO LEN(A$)
500 X$=X$+CHR$(ASC(MID$(A$,Q,1))+128):REM  SET BIT 7 (MOST
510 REM                      SIGNIFICANT BIT) OF EACH CHARACTER
520 REM                      IN THE STRING.
530 NEXT Q
540 RETURN
READY
```

Listing 4.

```
REM  ************************************************************
REM
REM              SORCERER REVERSE VIDEO PRINTING
REM                    DEMONSTRATION PROGRAM
REM
REM                    by Dwayne E. Smith
REM
REM
REM       This is a simple program that may be used to see the
REM     use of the reverse video subroutine in CBASIC-2. The
REM     function FN.REVERSE.VIDEO$ is passed the string which
REM     is to be displayed in reverse video. The function need
REM     only appear in a PRINT statement for the string to be
REM     printed in reverse video.
REM
REM  ************************************************************

     REM    Set the constants

          PROG.LOC%        = 0A986H        REM  Location of program \
                                                REVIDEO.COM in a 48K \
                                                system (AA06H - 80H).


          PROG.NAME$       = "REVIDEO.COM"

          CLEAR.SCREEN$    = CHR$(12)      REM  Char. to clear screen
          ESCAPE$          = CHR$(27)      REM  ESC key

          NULL$            = ""



     REM    Clear the screen before calling the reverse video \
                 subroutine.

          PRINT CLEAR.SCREEN$


     REM    Define the Reverse Video Printing Function

          DEF FN.REVERSE.VIDEO$(Z$)
```

More

Listing 4 continued.

```
            X$ = NULL$
            FOR Q% = 1 TO LEN(Z$)
                X$ = X$ + CHR$(ASC(MID$(Z$,Q%,1)) OR 80H)  REM \
                          Take each character in Z$ , and set bit 7 \
                          (the most significant bit). This will change \
                          the character into the reverse video of \
                          the original character.
            NEXT Q%
            FN.REVERSE.VIDEO$ = X$
            RETURN
        FEND

    REM     Load the reverse video machine language subroutine.

        SAVEMEM 80H, PROG.NAME$          REM  Save 128 bytes for \
                                              subroutine, and load \
                                              it into memory.


    REM     Execute the subroutine

        CALL     PROG.LOC%



    REM     Get the string input, and print in normal & reverse video

        PRINT "Enter some characters and hit the RETURN key. To"
        PRINT "quit, type the ESC key, then the RETURN key."
        PRINT : PRINT

10      INPUT STRING$
        IF STRING$ = ESCAPE$ THEN STOP
        PRINT STRING$, FN.REVERSE.VIDEO$(STRING$)
        PRINT
        GOTO 10
```

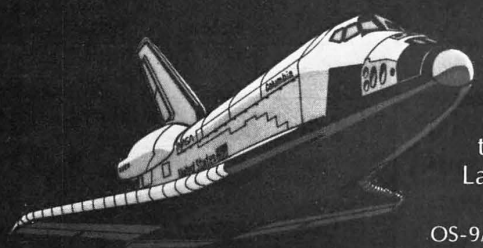
The initialization routine includes writing the Sorcerer graphics symbols into the locations FC00H to FDFFH. Since some of the characters occupy these locations, they are lost by this process.

This problem can be dealt with by simply re-executing the subroutines, which can be kept in memory. If used with CP/M, a control-C should rewrite the reverse video characters. If used in Basic (as in Listings 3 and 4), the clearing of the screen and the execution of the machine-language subroutine can be included in a subroutine of its own.

Conclusion

These ideas may also interest people who own memory-mapped video boards. The board must have enough programmable characters to hold the reverse character set. If your video board operates like the Sorcerer's video, the programs can probably be altered to work with your system. Other boards may require totally different methods. But I hope I've shown that reverse video with Exidy's Sorcerer is not only possible, but can be put to practical use. ■

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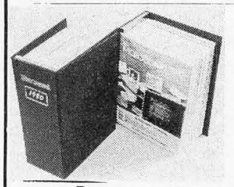
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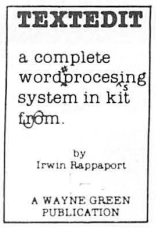
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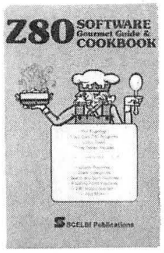
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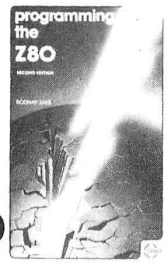
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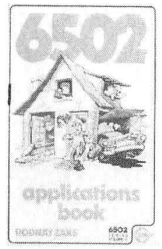
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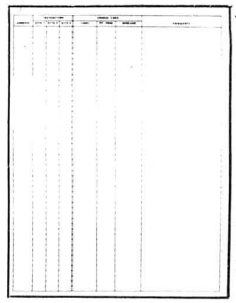


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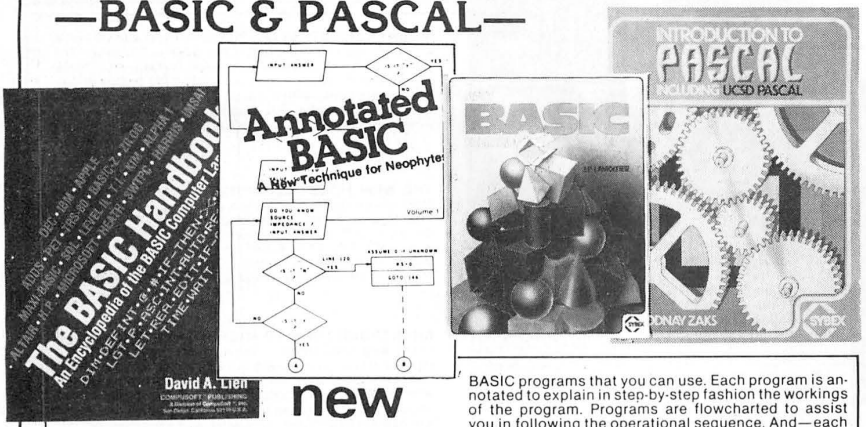
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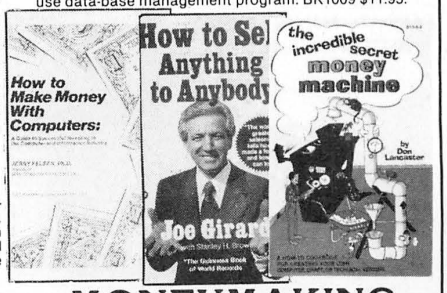
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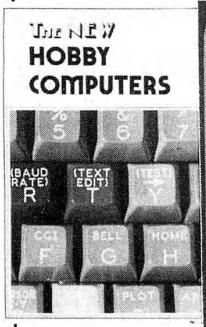
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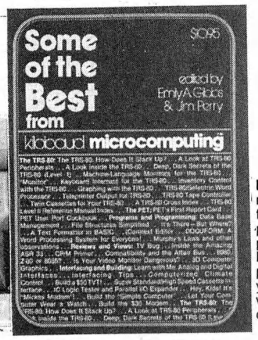
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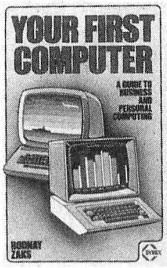
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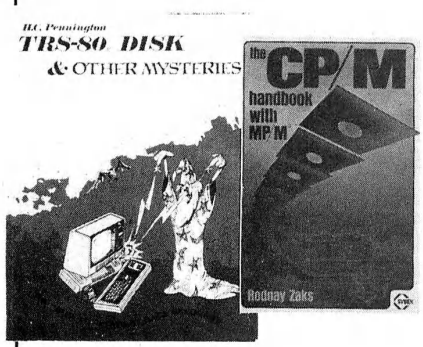
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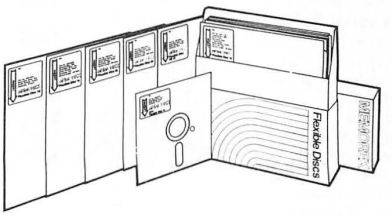
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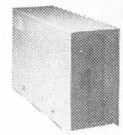
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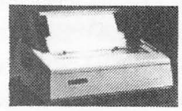
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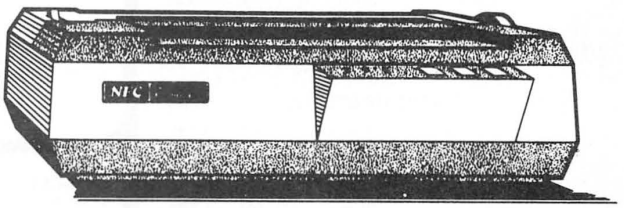
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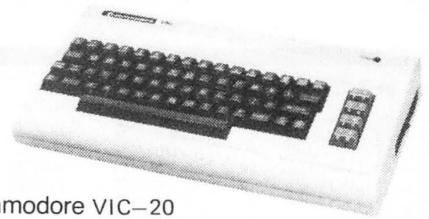


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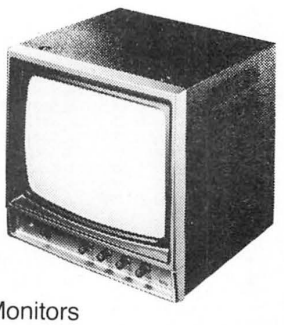
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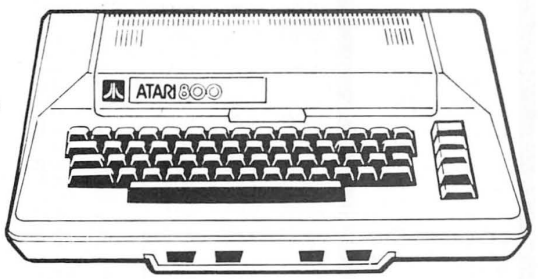
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74LS08	.35	74LS95	.85	74LS175	.95	74LS363	1.35
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74LS20	.25	74LS122	.45	74LS194	1.00	74LS374	1.75
74LS21	.35	74LS123	.95	74LS195	.95	74LS377	1.45
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74LS27	.35	74LS126	.85	74LS221	1.20	74LS385	1.90
74LS28	.35	74LS132	.75	74LS240	.99	74LS386	.65
74LS30	.25	74LS136	.55	74LS241	.99	74LS390	1.90
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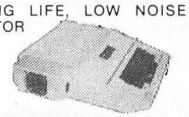
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74S03	.48	74S86	1.44	74S169	5.44	74S260	1.83
74S04	.79	74S112	1.59	74S174	1.09	74S274	19.95
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74S10	.69	74S132	1.24	74S188	3.95	74S288	4.45
74S11	.88	74S133	.98	74S189	14.95	74S289	6.98
74S15	.70	74S134	.69	74S194	2.95	74S301	6.95
74S20	.68	74S135	1.48	74S195	1.89	74S373	3.45
74S22	.98	74S138	1.08	74S196	4.90	74S374	3.45
74S30	.48	74S139	1.25	74S197	4.25	74S381	7.95
74S32	.98	74S140	1.45	74S201	14.95	74S387	5.75
74S37	1.87	74S151	1.19	74S225	8.95	74S412	2.98
74S38	1.68	74S153	1.19	74S240	3.98	74S471	9.95
74S40	.44	74S157	1.19	74S241	3.75	74S472	16.85
74S51	.78	74S158	1.45	74S244	3.98	74S474	17.85
74S64	.79	74S161	2.85	74S251	1.90	74S482	15.60
74S65	1.25	74S162	3.70	74S253	7.45	74S570	7.80
						74S571	7.80

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7400	.19	7451	.23	74136	.50	74186	18.50
7401	.19	7453	.23	74141	.65	74190	1.15
7402	.19	7454	.23	74142	2.95	74191	1.15
7403	.19	7460	.23	74143	2.95	74192	.79
7404	.19	7470	.35	74144	2.95	74193	.79
7405	.22	7472	.29	74145	.60	74194	.85
7406	.22	7473	.34	74147	1.75	74195	.85
7407	.22	7474	.35	74148	1.20	74196	.79
7408	.24	7475	.49	74150	1.35	74197	.75
7409	.19	7476	.35	74151	.65	74198	1.35
7410	.19	7480	.59	74152	.65	74199	1.35
7411	.25	7481	1.10	74153	.55	74221	1.35
7412	.30	7482	.95	74154	1.40	74246	1.35
7413	.35	7483	.50	74155	.75	74247	1.25
7414	.55	7485	.65	74156	.65	74248	1.85
7416	.25	7486	.35	74157	.55	74249	1.95
7417	.25	7489	4.95	74159	1.65	74251	.75
7420	.19	7490	.35	74160	.85	74259	2.25
7421	.35	7491	.40	74161	.70	74265	1.35
7422	.29	7492	.50	74162	.85	74273	1.95
7423	.29	7493	.49	74163	.85	74276	1.25
7425	.29	7494	.65	74164	.85	74279	.75
7426	.29	7495	.55	74165	.85	74283	2.00
7427	.29	7496	.70	74166	1.00	74284	3.75
7428	.45	7497	2.75	74167	2.95	74285	3.75
7430	.19	74100	1.00	74170	1.65	74290	.95
7432	.29	74107	.30	74172	5.95	74293	.75
7433	.45	74109	.45	74173	.75	74298	.85
7437	.29	74110	.45	74174	.89	74351	2.25
7438	.29	74111	.55	74175	.89	74365	.65
7440	.19	74116	1.55	74176	.89	74366	.65
7442	.49	74120	1.20	74177	.75	74367	.65
7443	.65	74121	.29	74178	1.15	74368	.65
7444	.69	74122	.45	74179	1.75	74376	2.20
7445	.69	74123	.55	74180	.75	74390	1.75
7446	.59	74125	.45	74181	2.25	74393	1.35
7447	.69	74126	.45	74182	.75	74425	3.15
7448	.69	74128	.55	74184	2.00	74426	.85
7450	.19	74132	.45	74185	2.00	74490	2.55

HOURS: Mon. - Fri., 9 to 5; Sat. 11 to 3

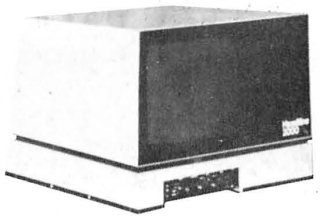
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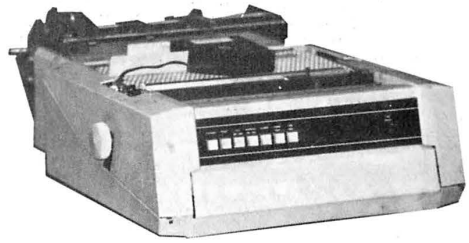


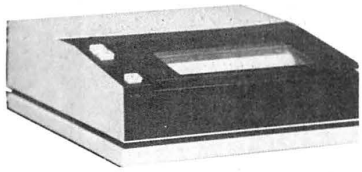
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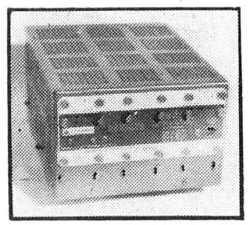
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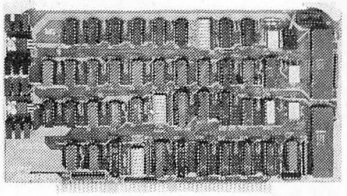
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Runs CPM 80™, CPM 86™, And MPM86™ AT THE SAME TIME! 8 AND/OR 16 BIT TOGETHER! WOW!

KEGBTMPM816 — *Software* — $995.00

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2/4 MHZ Z80A CPU with RS232C Serial I/O Port complete with Monitor PROM for 2422 Disk Controller

KECCS 2810A — A & T ..... $350.00 .... $280.00

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S-100 I/O BOARDS

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KEGBT162C	CSC	$495.00	$460.00
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KEGBT162AM1	A&T with 8231 Math Chip		$555.00
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2 RS232 C ports, 2 8 bit parallel ports, & optional 2K ROM

KECCS271901 — A & T — $360.00 — $325.00

2720 4 PORT PARALLEL - CCS

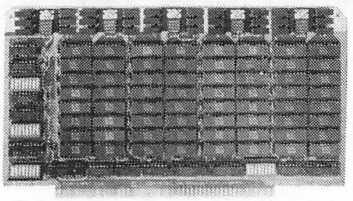
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RAM 20 - 32K
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KEGBT164AC16	16K CSC	$355.00	$325.00
KEGBT164AA24	24K A&T	$355.00	$325.00
KEGBT164AC24	24K CSC	$425.00	$385.00
KEGBT164AA32	32K A&T	$425.00	$299.00
KEGBT164AC32	32K CSC	$495.00	$450.00

CMOS STATIC RAM

For a complete analysis of the advantages of CMOS memory, see the "Product Description" on page 416 of the January Issue of **BYTE.**

64K CMOS STATIC RAM - COMPUPRO

RAM 17, 10 MHZ, 2 Watt, DMA Compatable 24 Bit Addressing

KEGBT175A64	64K A&T	$599.00	$550.00
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8 and/or 16 Bit

(816) RAM 16 10 MHZ, 32K x 16 or 64K x 8 IEEE/696 16 BIT 2 Watt, 24 Bit Addressing

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1K/16K 2708 EPROM board, disable in 1K increments

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S-100 VIDEO BOARDS

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KEGBT144C	CSC	$449.00	$399.00
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KESSMVB3K24	80 x 24 Kit		$425.00
KESSMVB3A24	80 x 24 A&T	$499.00	$440.00
KESSMVB3UP	80 x 50 Line Upgrade		$ 39.00

VB2-S.S.M.

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VBBB - S.S.M

Memory Mapped Video Board 64 x 16 character display or 64 x 16 graphics display

KESSMVB1K	Kit		$179.00
KESSMVB1A	A & T	$242.00	$220.00

S-100 CLOCK CALENDAR

KEQTCCCSA — *Assembled & Tested* — $150.00

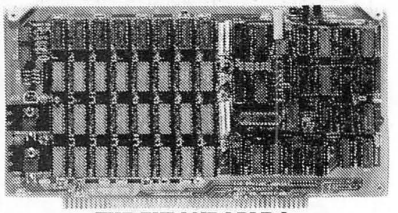
As seen in March Kilobaud Magazine

S-100 MOTHERBOARDS - COMPUPRO

Active termination, 6-12-20 slot

KEGBT153A	A&T 6 slot, 2 lbs	$140.00	$126.00
KEGBT153C	CSC 6 slot, 2 lbs.	$190.00	$175.00
KEGBT154A	A&T 12 slot, 3 lbs.	$175.00	$155.00
KEGBT154C	CSC 12 slot, 3 lbs.	$240.00	$220.00
KEGBT155A	A&T 20 slot, 4 lbs.	$265.00	$235.00
KEGTB155C	CSC 20 slot, 4 lbs.	$340.00	$310.00

S-100 DYNAMIC RAM



THE EXPANDABLE 1
PRIORITY 1 ELECTRONICS

THE EXPANDABLE 1™ 64K Dynamic Ram board provides your S-100 system with 64K of reliable, high-speed dynamic RAM. Compatable with most of the major S-100 systems on the market, including those with front panels, it supports DMA operations and requires no Wait states with current microprocessors.

- *User expandable from 16 to 64K*
- *Supports DMA*
- *Designed to IEEE proposed S-100 bus standards*
- *2 or 4 MHz operation*
- *Operates with either an 8080 or Z-80 based S-100 system, providing processor-transparent refreshes with both*
- *Supports IMSAI-type front panels*
- *Jumper-selectable Phantom input*
- *Uses Popular 4116 RAMS*
- *All ICs in sockets*
- *Any 16K block can be made bank-independent*
- *Fully buffered address and data lines*
- *Fail-safe refresh circuitry for extended Wait states*
- *Board configuration with reliable, easy-to-configure Berg jumpers*

KEPRIEXP116	16K Assembled & Tested		$299.00
KEPRIEXP132	32K Assembled & Tested		$339.00
KEPRIEXP148	48K Assembled & Tested		$379.00
KEPRIEXP164	64K Assembled & Tested		$409.00

S-100 DISK CONTROLLERS

2422A - CA. COMP. SYST.

I/O Mapped, controls 8", single or double density A&T with CPM 2.2 8" S.D.

		LIST PRICE	OUR PRICE
KECCS2422A		$475.00	$375.00

DISK JOCKEY 2D - MORROW

Memory Mapped, controls 8", single or double density, serial I/O

KEMDIDJ2208 — A&T with CP/M 2.2 — $399.00 — $375.00

S-100 DISK SUBSYSTEMS

DJ2B DISCUS SINGLE SIDED MORROW

8" DBL Density drives with cabinet, power supply controller, with CP/M 2.2 and Microsoft Basic

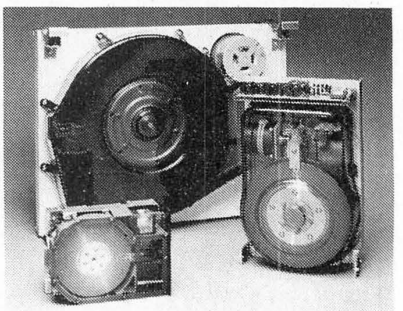
KEMDSF1218	Single Drive System	$1095.00	$950.00
KEMDSF1228	Dual Drive System	$1875.00	$1598.00

DJ2B DISCUS DOUBLE SIDED - MORROW

8" DBL Density/sided drives with cabinet Power supply controller, with CP/M 2.2 and Microsoft Basic

KEMDSF2218	Single Drive System	$1395.00	$1250.00
KEMDSF2228	Dual Drive System	$2495.00	$2050.00

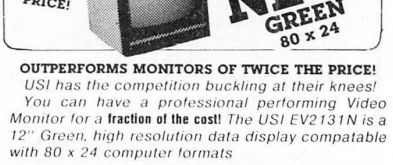
S-100 HARD DISK - MORROW



5.25" 5MB, 8" 10 & 20MB, 14" 26MB formatted hard disk complete with cabinet, P.S., Controller, CP/M 2.2 and Microsoft MBASIC 80

		LIST PRICE	SALE PRICE
KEMDSDMAM5	5 MB	$2495.00	$1995.00
KEMDSM10S	10 MB	$3695.00	$2950.00
KEMDSM20S	20 MB	$4795.00	$3825.00
KEMDSM26S	26 MB	$4495.00	$3495.00

WOW!



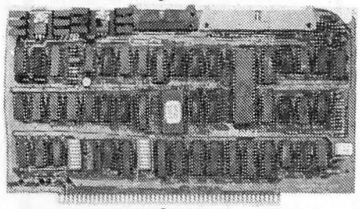
OUTPERFORMS MONITORS OF TWICE THE PRICE!

USI has the competition buckling at their knees! You can have a professional performing Video Monitor for a **fraction of the cost!** *The USI EV2131N is a 12" Green, high resolution data display compatable with 80 x 24 computer formats*

KEUSIEV2131N — *24 lbs.* — $149.00

PRIORITY ONE ELECTRONICS

COMPUPRO DMA DISK 1 WITH FREE CP/M 2.2 SALE $450.00



SAVE $220.00

Priority 1 Electronics is pleased to offer the COMPUPRO DISK 1 High Performance Disk Controller at our regular low price with CP/M 2.2 and BIOS at no additional cost. That's a savings of $220.00 of the manufacturer's list price.

- *Third generation INTEL 8272/NEC 765A LSI floppy disk controller.*
- *High speed cycle stealing DMA interface for processor independent data transfer between system memory and flexible disk.*
- *Handles up to four 8 or 5.25 inch floppy disk drives*
- *Single or double density/single or double sided capability.*
- *Supports IBM 3740 soft sectored formats.*
- *24 bit DMA addressing with data transfer across 64K boundaries for data transfer throughout the 16Mbyte memory map.*

PART NO.	DESCRIPTION	LIST PRICE	OUR PRICE
KEPDB171ACPM	A&T w/CP/M 2.2 & BIOS	$670.00	$450.00
KEGBT171C	CSC	$595.00	$555.00
KEGBTCPM80*	CP/M 2.2 for Z80/8085 with manuals & BIOS 8" S/D disk		$175.00
KEGBTOAS8S	Oasis 8 bit single user 8" S/D disk		$500.00
KEGBTOAS8M	Oasis 8 bit multiuser, 8" S/D disk		$850.00

S-100 SYSTEMS

SUPERSIXTEEN — COMPUPRO

HERE IS WHAT EACH PACKAGE INCLUDES:

KEGBT1612A *6 MHz 8085/8088 Dual Processor Board*
KEGBT171A *High Speed DMA Disk Controller*
KEGBT162A *System Support 1 Multi-Function Board*
KEGBT133A *Interfacer 1 Dual Serial I/O*
KE128K 10MHz *Low Power Static Ram*
KEGBTCP/M 86 *16 Bit Operating System Ready to Load & Go*
Cables and Documentation *Three interfacer cables one disk I/O cable, complete documentator for all hardware, and manuals for both CP/M operating systems.*
Compu Pro's *famous* **1 Year** *limited warranty.*

Now to the best part of all. If purchased separately, these quality components would list for $4,344.00. **BUT SuperSixteen's low package price is an amazing $3,495.00. You save $849.00!** *(For boards qualified under the Certified System Component high-reliability program - with extended 2 year warranty, 200 hour burn-in and 6/8 MHz processors - add $600.00 to the package price.* Sh. Wt. 15 lbs.

KEPDBGBTSJ	SuperSixteen A&T	$3495.00
KEPDBGBTSK	SuperSixteen CSC	$4095.00

PRINTERS

BEST PRICE!



MICROLINE — OKIDATA

WITH FRICTION AND TRACTOR FEED

- *Bi-DIRECTIONAL - 120 CPS*
- *9x9 Matrix (Alphanumeric)*
- *6x9 or 12 Matrix for Graphics*
- *5,8.3, 10,16 Charactrs p/Inch*
- *6 or 8 Lines per Inch*
- *80 CPL@10 CPI for 82A*
- *132 CPL@10 CPI for 83A*
- *Parallel and Serial I/O*
- *100 Thru 1200 Baud*
- *Self Test*
- *Out of Paper Switch*
- *Friction or Tractor Feed*
- *3" to 14" Top of Form (Switch Selectable)*
- *10 Different Character Sets*

PART NO.	DESCRIPTION	LIST PRICE	SALE PRICE
KEOKIDAT82AT(26 lbs)	8 80 CPL @ 10 CPI $ 799.00		$539.00
KEOKIDAT83AT (37 lbs)	132 CPL @ 10 CPI $1195.00		$750.00
KEOKISER2KBF	9600 baud with 2K Serial Buffer upgrade with X-on Y-off		$159.00
KEOKIGRAPH	High Resolution Graphics Prom		$99.00

CALL FOR THE NEW MICROLINE 84

MX80 — EPSON

NEED WE SAY MORE?

KEEPNMX80	Tractor Feed 17 lbs	$645.00	$450.00
KEEPNMX100	132 Col. Tractor Feed 24 lbs		$725.00

PRINTER INTERFACES - MICROBYTE

RS232 Serial Conversion for MX80

KEMBSSEI1	A & T	$55.00
	Apple Centronics 8 bit parallel interface for Centronics, Epson & OKIDATA printers	
KEMBSAEI1	A & T	$55.00
KEMBSAEC1	*Cable for above*	$14.95

Printer interfaces & cables sold only with printer purchase

S-100 MAINFRAMES



S-100 MICROFRAME - TEI

110V 60HZ CVT Mainframes, the best money can buy!
12 Slot ±8V 17A±16V @ 2A
22 Slot ±8V @ 30A± 16V @ 4A

PART NO.		LIST PRICE	OUR PRICE 1-9	10-24
KETEIMCS 112	12 Slot Desk	$685.00	$615.00	$570.00
KETEIMCS 122	22 Slot Desk	$825.00	$760.00	$705.00
KETEIRM 12	12 Slot Rackmount	$725.00	$720.00	$619.00
KETEIRM 22	22 Slot Rackmount	$875.00	$850.00	$750.00

Shipping Weight: On 12 Slot Mainframe 45 lbs.
On 22 Slot Mainframes 55 lbs.

TEI S-100 FRAMES
3 - 5" DISK CUTOUTS

±8V @ 17±16V @ 1.2A, Internal Cables

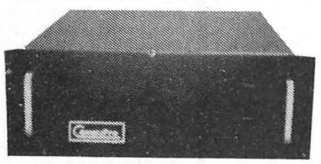
			1-9	10-24
KETEITF12	12 Slot desk	$675.00	$625.00	$580.00
KETEIRF12	12 Slot Rackmount	$795.00	$715.00	$665.00

Shipping Weight: On 12 Slot Desk 40 lbs.
On 12 Slot Rackmount 45 lbs.

DUAL 8" DISK DRIVE CHASSIS - TEI

For Shugart 800/801R or 850/851R with internal power cables provided
+24V @ 1.5A+5V @ 1.0A - 5V @ .25A

			1-9	10-24
KETEBCFDO	Desk Top	$535.00	$485.00	$455.00
KETEIRFDO	Rack Mount	$720.00	$670.00	$630.00



S-100 MAINFRAME - COMPUPRO

110V 60HZ CVT Mainframe uses famous 20 slot COMPUPRO Motherboard. 55 lbs.

KEGBTENC20RM	20 Slot Rack Mount	$895.00	$825.00
KEGBTENC20DK	20 Slot Desk Top	$825.00	$760.00

S-100 MAINFRAME - CCS

12-slot motherboard with removable termination card

KECCS220001	Office Cream	35 lbs	$575.00	$535.00
KECCS220002	Blue	35 lbs	$575.00	$535.00

SOFTWARE - MICROPRO

All software is supplied on 8" Single Density IBM 3740 CP/M Compatable Diskettes

WORDSTAR
Screen-Oriented, integrated word processing system specifically designed for non-technical personnel
KEMPRWRDSTAI $495.00 **$300.00**

MAIL MERGE WORD STAR OPTION
Powerful file merging tool
KEMPRMLMRGAI *(Requires Word Star 2.1 or later)* $250.00 **$100.00**

SPELLSTAR WORD STAR OPTION
One Step "Proofreader" with compressed 20,000 word dictionary and user-created supplemental dictionaries
KEMPRSPLSTAI *(Requires Word Star 3.0 or later)* $250.00 **$150.00**

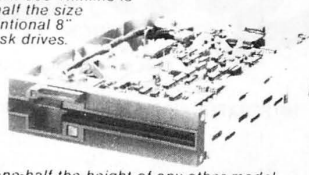
SUPERSORT
Sophisticated program that will select and re-arrange variable length information from data files
KEMPRSPRSRAI $250.00 **$150.00**

CALC STAR
Sophisticated, easy-to-use, electronic spread sheet and financial planner
KEMPRCLCSTAI $295.00 **$200.00**

DATA STAR
Office-Oriented Data Entry, retrival, and updating system
KEMPRDATSTAI $350.00 **$200.00**

FLOPPY DISC DRIVES

Tandon TM-800 Thinline is exactly half the size of conventional 8" floppy disk drives.



1 ONE

Exactly one-half the height of any other model.
Propietary, high-resolution, read-write heads patented by Tandon
D.C. only operation - no A.C. required
Industry standard interface.
Three millisecond track-to-track access time 9 lbs.

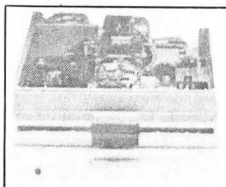
KETNDTM8481	Single Sided $425.00	2 or more	$395.00
KETNDTM8482	Double Sided $575.00	2 or more	$550.00
KETNDTM8M	Manual - not included with drive		$ 10.00

80IR - SHUGART

Single sided double density most popular 8" drive

KESHU80IR	$425.00 ea or 2 or more (16 lbs) for	$395.00 ea.
KESHUSA80IRM	Manual for 80IR drives	$ 10.00

DT-8 - QUME



DT-8 - QUME

2 OR MORE $499.00

Data track 8 double sided, double density 8"
KEQMEDT8WH *Sh. Wt. 16 lbs* **$550.00 ea.**

2 or more $525.00 each

KEQMEDT8M *Manual for DT-8* $ 10.00

5¼" DRIVES - TANDON

KETNDTM1001 *Single Sided, 250KB (5 lbs)* **$249.00* ea.**
2 or More $220.00
KETNDTM1002 *Double Sided, 500KB* **$325.00 ea.**
2 or More $299.00
KETNDTM1003 *Single Sided, 500KB* **$325.00 ea.**
2 or More $299.00
KETNDTM1004 *Double Sided, 1000KB* **$449.00 ea.**
2 or More $420.00
KETNDTM5M *Manual, not included with drive* $ 10.00

**As used in the IBM P.C.*

DISK CABINETS

V-100 - VISTA

• Desk or rack mountable • Internal power and data cables • Drives pull out for easy service and maintenance
KEVISV100 *Disk Drive Cabinet (43 lbs)* $495.00 **$449.00**

SINGLE 8" - Q.T.

Single 8" cabinet with power supply
KEQTCDDC8 *(22 lbs)* $249.00 **$225.00**

DUAL 8" - Q.T.

Dual 8" cabinet with power supply
KEQTCDDC88 *(24)* $395.00 **$349.00**

5" CABINETS - VISTA

KEVIS 9801 *Single 5" with P.S.* **$75.00**
KEVIS 9802 *Dual 5" with P.S.* **$95.00**

TERMINALS



SALE! $525.00

VIEWPOINT — ADDS

Detachable keyboard, RS232 interface and auxiliary port, 80 x 24 display, tiltable screen **SALE**
KEADDVWPR *Shipping Weight 30 lbs* $699.00 **$525.00**

VT200 — VISUAL TECHNOLOGY

THE MOST RELIABLE TERMINAL WE'VE EVER USED!

Detachable keyboard, RS232C or 20MA interface, 110 to 19200 baud, 12" non glare 80 x 24 display, RS232 Aux. port and composite video out.
KEVSL200 *Shipping Weight 55 lbs.* **$995.00**

✓ 277

master charge VISA

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7400TTL

7400N	19	LM317T	1 65	CD4017	1 05	8T26	1 69	UART-FIFO	
7400N	19	LM317K	3 75	CD4018	94	8T28	1 95	AY5-1013	3 95
7402N	19	LM318	1 49	CD4019	45	8T97	99	AY5-1014	6 95
7404N	22	LM320K-5	1 35	CD4020	95	8T98	99	3341	6 95
7409N	19	LM320K-12	1 35	CD4021	95	**MOS MEMORY RAM**		**PROM**	
7410N	19	LM320K-15	1 35	CD4022	1 10	2101-1	1 95	1702A	4 50
7414N	55	LM320T-5	85	CD4023	28	2102-1	85	2532	17 50
7420N	19	LM320T-8	85	CD4024	75	2102AL-4	1 25	2708	2 95
7430N	19	LM320T-12	85	CD4025	23	2102AN-2L	1 65	2716†	8 50
7442N	49	LM320T-15	85	CD4026	1 65	2104A-4	4 95	2716 5 Volt	5 50
7445N	69	LM323K-5	4 95	CD4027	65	2107B-4	3 75	8-2716 5 Volt	39 00
7447N	69	LM324N	59	CD4028	80	2111-1	2 99	2732	16 50
7448N	69	LM339N	99	CD4029	95	2112-2	2 99	2758	7 49
7474N	35	LM340K-5	1 35	CD4030	45	2114	2 24	8741A	39 95
7475N	49	LM340K-8	1 35	CD4035	85	2114L 300ns	2 50	8748	39 95
7485N	65	LM340K-12	1 35	CD4040	95	2114L 450ns	2 37	8748-8	14 95
7489N	1 70	LM340K-15	1 35	CD4042	75	4116 200ns	2 50	8755A	49 95
7490N	35	LM340K-24	1 35	CD4043	85	8 4116 200ns	15 40	N82S23	2 95
7495N	55	LM340T-5	75	CD4044	85	MM5280	3 00	N82S123	3 95
74100N	1 00	LM340T-8	75	CD4046	95	MM5321	9 95	N82S126	5 75
74107N	30	LM340T-12	75	CD4049	45	MM5330	5 94	N82S129	4 75
74123N	55	LM340T-15	75	CD4050	55	P5101L	8 95	N82S131	4 95
74125N	45	LM340T-18	75	CD4051	95	4200A	11 50	N82S136	8 75
74145N	60	LM340T-24	75	CD4060	1 42	9368	3 50	N82S137	8 75
74150N	1 20	LM350T	5 50	CD4066	71	4100	10 00	DM8577	2 90
74151N	65	LM377	2 29	CD4068	39	416	2 50	8223	3 50
74154N	1 25	LM380N	1 00	CD4069	35	TMM2016	16 95	**CONNECTORS**	
74157N	55	LM381	1 60	CD4070	35	HM6116	16 50	30 pin edge	2 50
74161N	70	LM382	1 60	CD4071	30			44 pin edge	2 75
74162N	85	LM709H	59	CD4072	30	**CLOCKS**		86 pin edge	4 00
74163N	85	LM723H N	49	CD4073	35	MM5311	4 95	100 pin edge	3 95
74174N	89	LM733N	85	CD4075	30	MM5312	3 90	100 pin edge w/w	4 95
74175N	85	LM741CH	35	CD4076	95	MM5314	3 90		
74190N	1 15	LM741N	35	CD4078	30	MM5369	1 95	**IC SOCKETS**	
74192N	79	LM747H N	75	CD4081	30	MM5841	14 45	**Solder Tin Low Profile**	
74193N	79	LM748N	50	CD4082	30	MM5865	7 95	**PIN 1UP PIN 1UP**	
74221N	1 25	LM1303N	1 75	CD4116	47	CT7010	8 95	8	13 22 30
74298N	85	LM1304	1 10	CD4490	5 50	CT7015	8 95	14	14 24 30
74365N	65	LM1305	1 27	CD4507	99	MM5375AA-N	3 90	16	16 28 40
74366N	65	LM1307	1 10	CD4508	1 95	MM5375AG-N	4 90	18	20 36 58
74367N	65	LM1310	2 75	CD4510	95	7205	16 50	20	29 40 49
		LM1458	55	CD4511	94	7207	7 50		
74LS00 TTL		LM1812	8 25	CD4515	2 25	7208	15 95	**WIRE WRAP LEVEL 3**	
74LS00N	25	LM1889	2 49	CD4516	1 10	7209	4 95	**PIN**	**PIN**
74LS02N	25	LM2111	1 75	CD4518	1 25			14 55 24 53	
74LS04N	25	LM2902	2 25	Cu4520	1 02	**MICROPROCESSOR**		16 57 28 1 00	
74LS05N	25	LM3900N	59	CD4527	1 51	6502	6 95	18 67 40 1 59	
74LS08N	35	LM3905	1 25	CD4528	1 25	6502A	9 50	2 level 14 pin w w	20
74LS10N	25	LM3909N	95	CD4553	3 50	6504	6 95		
74LS13N	45	MC1458V	55	CD4566	2 45	6522	8 75		
74LS14N	99	NE550N	1 30	CD4583	2 35	6530	9 50		
74LS20N	25	NE555V	59	CD4585	95	6532	14 95		
74LS22N	25	NE556A	65	CD40192	3 00	6551	11 85		
74LS28N	35	NE565A	1 00	CD4000	35	6800	5 70		
74LS30N	25	NE566H	1 50	CD4001	35	6802	11 95		
74LS33N	55	NE567V	1 00	CD4002	35	6820	4 95		
74LS38N	35	NE570B	4 75	CD4011	35	6850	3 50		
74LS74N	45	78L05	60	CD4012	35	8080A	3 95		
74LS75N	50	78L08	60	CD4013	35	8085A	8 50		
74LS90N	60	78M05	85	CD4014	1 95	Z80A	5 00		
74LS93N	65	75108	1 95	CD4015	95	Z80B	18 95		
74LS95N	85	75491CN	50	CD4016	80	Z80 P10	6 50		
74LS107N	40	75492CN	55	CD4017	1 25	Z80A P10	5 95		
74LS112N	45	75494CN	85	CD4093	1 25	Z80 CTC	5 95		
74LS113N	45			CD4154	3 25	Z80A CTC	8 65		
74LS132N	75	**A to D CONVERTER**		CD4160	1 69	Z80 DART	15 25		
74LS136N	49	8038B	4 50	CD4175	1 19	Z80A DART	18 75		
74LS151N	75	8700CJ	13 95	CD4192	1 65	Z80 DMA	17 50		
74LS155N	79	8701CN	13 95	CD4221	1 90	Z80A DMA	27 50		
74LS157N	75	8750CJ	13 95	CD4905	6 00	Z80 S10 0	23 95		
74LS162N	95	LD130	9 95	CD4906	75	Z80A S10 0	28 95		
74LS163N	95	94000J-7	7 40	CD4914	1 95	Z80 S10 1	15 00		
74LS174N	95	ICL7103	9 50	CD4922	5 00	Z80A S10 1	23 90		
74LS190N	1 00	ICL7107	14 25	CD4923	5 50	Z80 S10 2	23 95		
74LS221N	1 19			CD4925	5 75	Z80A S10 2	28 95		
74LS258N	69	**CMOS**		CD4926	6 95	Z80B CTC	17 95		
74LS367N	69	CD4000	25	CD4927	6 95	Z80B P10	17 95		
		CD4001	35			8212	1 85		
LINEAR		CD4002	35	**INTERFACE**		8214	3 75		
CA3045	90	CD4006	95	8095	65	8216	1 80		
CA3046	1 10	CD4007	25	8096	65	8224	2 50		
CA3081	1 80	CD4008	95	8097	65	8226	4 95		
CA3082	1 90	CD4009	45	8098	65	8251	4 75		
CA3089	3 40	CD4010	45	8T09	1 25	8253	8 95		
LM301AN-AH	34	CD4011	35	8T10	1 75	8255	4 75		
LM305H	87	CD4012	25	8T11	1 40	8257	4 75		
LM307N	35	CD4013	45	8T23	1 75	8259	6 90		
LM308N	98	CD4014	95	8T24	1 75	1802CE plas	13 95		
LM309K	1 25	CD4015	95	8T25	3 20	1802E plas	17 95		
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DE9S	1 95
DA15P	2 10
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Complete Set	9 50
Stopwatch Kit	**26 95**
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RESISTORS ¼ watt 5%

10 per type	05
100 per type	015
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5000 per type	0085
350 piece pack, 5 per type	8 95

½ watt 5% per type 05

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4-position	85
6-position	90
7-position	95
8-position	95

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56 key ASCII keyboard kit	$74 95
Fully assembled	84 50
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Metal Enclosure	69 95

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Red T01¾	15
Green, Yellow T01¾	20
Jumbo Red	25
Green, Orange, Yellow Jumbo	25

Cliplite LED Mounting Clips 4 80
(spec. red, amber, green, yellow, clear)

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Complete line of breadboard test equip

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Complete line of AP Products in stock

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6V 500 ma	$4 00	10V 2 amp	$7 95
6 3V CT 600 ma	4 60	12V 250 ma	2 95
12V 250 ma	1 95	12V CT 250 ma	3 75
12 6V CT 600 ma	4 95	12V 500 ma	4 50
12 6V CT 2 amps	5 95	12V 1 amp	5 95
12 6V CT 4 amp	8 60	12V 2 amp	7 95
12 6V CT 8 amp	10 80	6, 9, 12 VDC	
24V CT 1000 ma	9 95	300 ma	8 95
24V CT 600 ma	4 95	9 VDC 500 ma	3 75

Constant Voltage Transformers 12V 11 amp, 5V 23 amp, 24V 11 amp 15 00

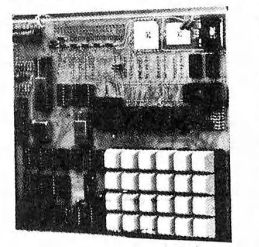
DISPLAY LEDS

MAN72 74	CA CA	300	75
DL704	CC	300	1 25
DL707/DL707R	CA	300	1 00
DL727-728	CA CC	500	1 90
DL747 750	CA CC	600	1 49
FND359	CC	357	79
FND500 507	CC CA	500	99
FND503-510	CC CA	500	90
FND800 807	CC CA	800	2 20
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7520 Clairex photocells			39
1IL311 Hex			9 50
MAN4610	CA	40	99
MAN4640	CC	40	1 20
MAN4710	CA	40	95
MAN4740	CC	40	1 20
MAN6640	CC	56	99
MAN6710	CA	60	99
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TELEVIDEO TERMINAL
Model 950 $980 00

4116 200ns Dynamic RAM 8/$15.40

1981 IC MASTER CLOSEOUT $59.95



RCA Cosmac 1802 Super Elf Computer $106.95

The Super Elf is a small single board computer that does many **big** things. It's an excellent computer for training and for learning programming with its machine language and yet it's easily **expanded** with **additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for **all** IC's are included plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game. Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and R&D.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95.** All metal Expansion Cabinet, painted and silk screened, with room for 5S-100 boards and power supply **$57.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also completely assembled and tested.

Questdata, a software publication for 1802 computer users is available by subscription for $12.00 per 12 issues. Single issues $1.50. Issues 1-12 bound $16.50.

Moews Video Graphics **$3.50,** Games and Music **$3.00,** Chip 8 Interpreter **$5.50,** Starship 4K cassette **$14.95.** Exciting and challenging space game. Complete manual included.

Free 14 page brochure
of complete Super Elf system.

Quest Super Basic V5.0

A new enhanced version of **Super Basic** now available. Quest was the first company worldwide to ship a full size Basic for 1802 Systems. A complete function **Super Basic** by **Ron Cenker** including floating point capability with scientific notation (number range ± $17E^{38}$), 32 bit integer ±2 billion; multi dim arrays, string arrays; string manipulation; cassette I/O; save and load, basic, data and machine language programs, and over 75 statements, functions and operations.

New improved faster version including **renumber** and essentially **unlimited variables.** Also, an exclusive user expandable command library

Serial and Parallel I/O routines included

Super Basic on Cassette $55.00.

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow **you** to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed**. EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatable cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50.** A **50 pin connector set** with ribbon cable is available at **$18.95** for easy connection between the **Super Elf** and the **Super Expansion Board.**

Power Supply Kit for the complete system (see Multi-volt Power Supply below).

ELECTRONIC SYSTEMS KITS

Apple Peripheral Kits

SERIAL I/O INTERFACE 0 to 30,000 baud, D.T.R., Input & output from monitor or basic, or use Apple as intelligent terminal, Bd only (P/N 2) **$14.95,** Kit (P/N 2A) **$51.25,** Assembled (P/N 2C) **$62.95.**

PROTOTYPING BOARD (P/N 7907) **$21.95.**

PARALLEL TRIAC OUTPUT BOARD 8 triacs, each can switch 110V, 6A loads, Bd only (P/N 210) **$19.20,** Kit (P/N 210A) **$119.55.**

OPTO-ISOLATED INPUT BOARD 8 inputs, can be driven from TTL logic, Bd only (P/N 120) **$15.65,** Kit (P/N 120A) **$69.95.**

Interface Kits

SERIAL/PARALLEL INTERFACE Bidirectional, Baud rates from 110 to 19.2K, sw selectable polarity of input and output strobe, 5 to 8 data bits, 1 or 2 stop bits, parity odd or even or none, all characters contain a start bit, +5 & −12V required.Bd only (P/N 101) **$11.95,** Kit (P/N 101A) **$42.89.**

RS-232/TTL INTERFACE Bidirectional, requires ±12V, Kit (P/N 232A) **$9.95.**

RS-232/20mA INTERFACE Bidirectional, 2 passive opto-isolated circuits, Kit (P/N 7901A) **$14.95.**

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Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled. 25 PROM capacity **$37.50** (with timer **$69.50**). 6 PROM capacity OSHA/UL version **$78.50** (with timer **$108.50**).

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Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Bare Board **$28.50.** Full Kit **$99.00.** Monitor **$20.00.** Power Supply Kit **$35.00.** Tiny Basic **$30.00.**

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Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12v option. ±5v, ±12v are regulated. Basic Kit **$35.95.** Kit with chassis and all hardware **$51.95.** Add $5.00 shipping. Kit of hardware **$16.00.** Woodgrain case **$10.00.** $1.50 shipping.

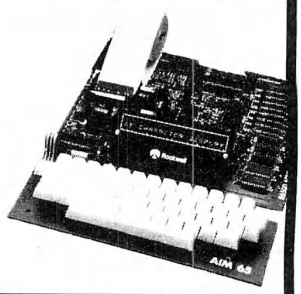
Type-N-Talk by Votrax

Text to speech synthesizer with unlimited vocabulary, built-in text to speech algorithm, 70 to 100 bits per second speech synthesizer, RS232C interface **$359.00.** Speech IC **$79.95.**

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Super Monitor VI.I Source Listing	**$15.00**



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6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display ROM monitor., fully expandable. **$419.00.** 4K version **$449.00.** 4K Assembler **$35.00.** 8K Basic Interpreter **$65.00**

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AIM 65/KIM/SYM/Super Elf 44 pin expansion board; board with 3 connectors **$22.95.**

Elf II Adapter Kit $24.95

Plugs into Elf II providing Super Elf 44 and 50 pin plus S-100 bus expansion. (With Super Expansion). High and low address displays, state and mode LED's optional **$18.00.**

Super Color S-100 Video Kit $129.95

Expandable to 256 x 192 high resolution color graphics. 6847 with all display modes computer controlled. Memory mapped. 1K RAM expandable to 6K. S-100 bus 1802, 8080, 8085, Z80, etc. **Dealers: Send for excellent pricing/margin program.**

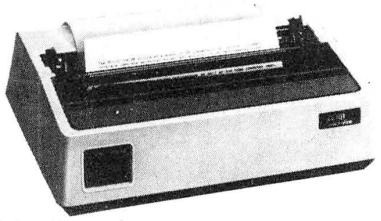
TERMS: $5.00 min. order U.S. Funds. Calif. residents add 6% tax. $10.00 min. VISA and MasterCard accepted. $1.00 insurance optional. Shipping: Add 5%; orders under $25.00—10%.

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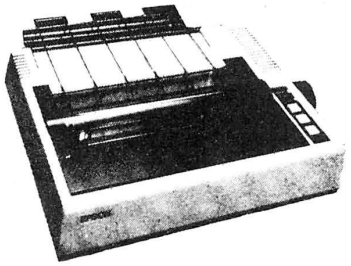
Microline 82A *80/132 column, **120 CPS**, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (optional), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking,* ***both serial & parallel interfaces included****, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*
PRM-43082 *Friction & pin feed* **$499.95**

Microline 83A *132/232 column, 120 CPS, handles forms up to 15" wide, removable tractor, plus all the features of the 82A.*
PRM-43083 *with FREE tractor* **$744.95**

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INEXPENSIVE PRINTERS - Epson



MX-70 *80 column, 80 CPS, 5 x 7 dot matrix, adjustable tractor feed, & graphics*
PRM-27070 *List $459* **$389.95**

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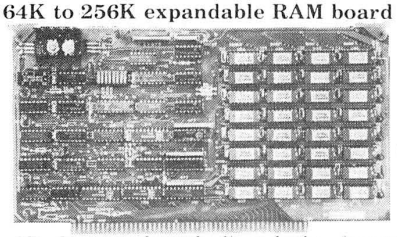
16K RAM Card for Apple II was $175, Now Only $74.95

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SD Systems ExpandoRAM III

64K to 256K expandable RAM board



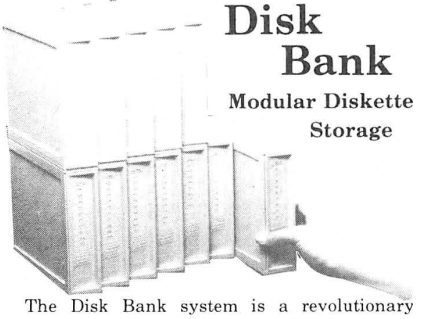
SD Systems has duplicated the famous reliability of their ExpandoRAM I and II boards in the new ExpandoRAM III, a board capable of containing 256K of high speed RAM. Utilizing the new 64K x 1 dymanic RAM chips, you can configure a memory of 64K, 128K, 192K, or 256K, all on one S-100 board. Memory address decoding is done by a programmed bipolar ROM so that the memory map may be dip-switch configured to work with either COSMOS/MPM-type systems or with OASIS-type systems.

Extensive application notes concerning how to operate the ExpandoRAM III with Cromemco, Intersystems, and other popular 4 MHz Z-80 systems are contained in the manual.

MEM-65064A *64K A & T* **$424.95**
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MEM-65192A *192K A & T* **$559.95**
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Disk Bank

Modular Diskette Storage

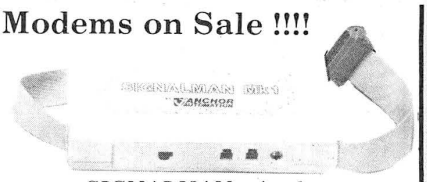


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The Disk Bank system can grow as your storage needs grow. Its modular interlocking design allows you to add to your system horizontally or verticallly. And Disk Bank's design allows easy accss to your diskettes. Just open the drawer and slide it out. The diskette retaining gate falls forward automatically for easy access to any of the 10 diskettes, without fear of bending or crimping. Shipping weight 1 lb.

MMA-405 *5¼" Disk Bank* **$4.95**
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IOM-5600A *Signalman* **$98.50**

SMARTMODEM - Hayes

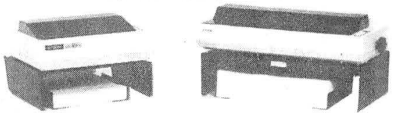
Sophisticated direct-connect auto-answer/auto-dial modem, touch-tone or pulse dialing, RS-232C interface, programmable
IOM-5400A *Smartmodem* **$249.95**
IOK-1500A *Hayes Chronograph* ... **$219.95**
IOM-2010A *Micromodem II* **$329.95**
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Apple-CAT - Novation

Software selectable 1200 or 300 Baud, direct connect, auto-answer/auto-dialse dialing, auxiliary 3-wire RS-232C serial port for printer
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FMJ Inc Printer Pal

Model P80 & P100



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PRA-99080 *P80, 10 lbs* **$24.95**
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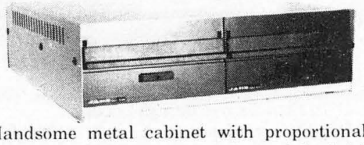
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Handsome metal cabinet with proportionally balanced air flow system • Rugged dual drive power supply • Power cable kit • Power switch, line cord, fuse holder, cooling fan • Never-Mar rubber feet • All necessary hardware to mount 2-8" disk drives, power supply, and fan • Does not include signal cable

Dual 8" Subassembly Cabinet

END-000420 *Bare cabinet* **$59.95**
END-000421 *Cabinet kit* **$225.00**
END-000431 *A & T* **$359.95**

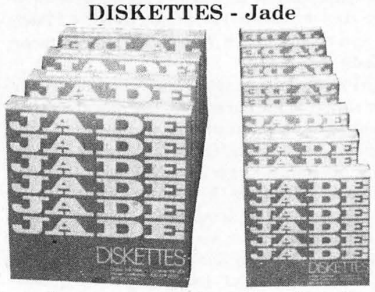
8" Disk Drive Subsystems
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END-000423 *Kit w/2 FD100-8Ds* . **$924.95**
END-000424 *A & T w/2 FD100-8Ds* **$1124.95**
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MMD—5121003 *SS, DD, 010* **$31.00**
MMD—5121603 *SS, DD, 16S* **$31.00**

8" Diskettes, Box of Ten

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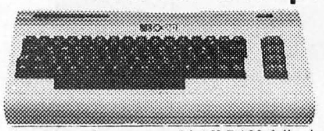
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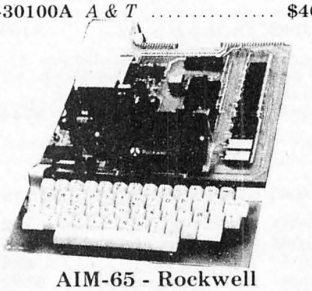
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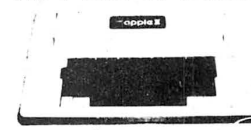
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You get all this in the starting level (Level A) of the Explorer/85 for only **$129.95.** Incredible! To use, just plug in your 8VDC power supply and terminal or keyboard/display — if you don't have them, see our special offers below.

☐ Level A computer kit (Terminal Version) . . . **$129.95** plus $3 P&I.*

☐ Level A kit (Hex Keypad/Display Version) . . . **$129.95** plus $3 P&I.*

LEVEL B — This "building block" converts the motherboard into a two-slot S100 bus (industry standard) computer. Now you can plug in any of the hundreds of S100 cards available.

☐ Level B kit . . . **$49.95** plus $2 P&I.*

☐ S100 bus connectors (two required) . . . **$4.85** each, postpaid.

LEVEL C — Add still more computing power: this "building block" mounts directly on the motherboard and expands the S100 bus to six slots.



☐ Level C kit . . . **$39.95** plus $2 P&I.*

☐ S100 bus connectors (five required) . . . **$4.85** each, postpaid.

LEVEL D — When you reach the point in learning that requires more memory, we offer two choices: either add 4k of a memory directly on the motherboard, or add 16k to 64k of memory by means of a single S100 card, our famous "JAWS."

Level D kit: (CHECK ONE) . . . ☐ 4k on-board . . . **$49.95** plus $2 P&I.*; ☐ 16k S100 "JAWS" . . . **$149.95** plus $2 P&I.*; ☐ 32k S100 "JAWS" . . . **$199.95** plus $2 P&I.*; ☐ 48k S100 "JAWS" . . . **$249.95** plus $2 P&I.*; ☐ 64k S100 "JAWS" . . . **$299.95** plus $2 P&I.*

LEVEL E — An important "building block," it activates the 8k ROM/EPROM space on the motherboard. Now just plug in our 8k Microsoft BASIC or your own custom programs.

☐ Level E kit . . . **$5.95** plus 50¢ P&I.*

Microsoft BASIC — It's the language that allows you to talk English to your computer! It is available three ways.

☐ 8k cassette version of Microsoft BASIC (requires Level B and 12k of RAM minimum; we suggest a 16k S100 "JAWS" — see above) . . . **$64.95** postpaid.

☐ 8k ROM version of Microsoft BASIC (requires Level B & Level E and 4k RAM; just plug into your Level E sockets. We suggest either the 4k Level D RAM expansion or a 16k S100 "JAWS.") . . . **$99.95** plus $2 P&I.*

☐ Disk version of Microsoft BASIC (requires Level B, 32k of RAM, floppy disk controller, 8" floppy disk drive) . . . **$325** postpaid.

TEXT EDITOR/ASSEMBLER — The editor/assembler is a software tool (a program) designed to simplify the task of writing programs. As your programs become longer and more complex, the assembler can save you many hours of programming time. This software includes an editor program that enters the programs you write, makes changes, and saves the programs on cassettes. The assembler performs the clerical task of translating symbolic code into the computer-readable object code. The editor/assembler program is available either in cassette or a ROM version.

☐ Editor/Assembler (Cassette version: requires Level "B" and 8k (min.) of RAM — we suggest 16k "JAWS" — see above) . . . **$59.95** plus $2 P&I.*

☐ Editor/Assembler (ROM version: supplied on an S100 card; requires Level B and 4k RAM (min.) — we suggest either Level D or 16k "JAWS") . . . **$99.95** plus $2 P&I.*

8" FLOPPY DISK — A remarkable "building block." Add our 8" floppy disk when you need faster operation; more convenient program storage; perhaps a business application, and access to the literally thousands of programs and program languages available today. You simply plug them into your Explorer/85 disk system — it accepts all IBM-formatted CP/M programs.

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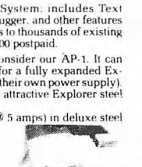
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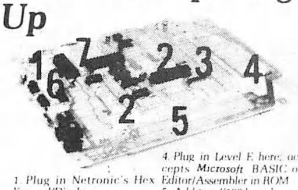
☐ CP/M 2.2 Disk Operating System: includes Text Editor/Assembler, dynamic debugger, and other features that give your Explorer/85 access to thousands of existing CP/M-based programs . . . $150.00 postpaid.

NEED A POWER SUPPLY? Consider our AP-1. It can supply all the power you need for a fully expanded Explorer/85 (note: disk drives have their own power supply). Plus the AP-1 fits neatly into the attractive Explorer steel cabinet (see below).

☐ AP-1 Power Supply kit (8V @ 5 amps) in deluxe steel cabinet . . . **$39.95** plus $2 P&I.*



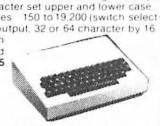
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3. Add 4k RAM
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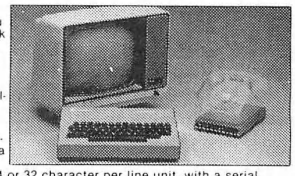
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74LS21	.35	74LS132	.99	74LS251	.99
74LS22	.35	74LS133	.89	74LS253	.99
74LS26	.35	74LS136	.49	74LS257	.89
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74S38	1.25	74S160	2.95	74S472	10.95
74S40	.50	74S174	1.59	74S473	10.95
74S51	.45	74S175	1.59	74S474	12.95
74S64	.50	74S188	2.95	74S475	12.95
74S65	.50	74S194	1.95	74S570	5.95
74S74	.75	74S195	1.95	74S571	5.95
74S86	.79	74S196	1.95	74S572	9.95
74S112	.79	74S240	2.95	74S573	9.95
74S113	.79	74S241	2.95	74S940	3.15
74S114	.79	74S242	3.25	74S941	3.15

CA–LINEAR

CA3010H	.99			CA3089N	3.75
CA3013H	2.15	CA3060N	3.25	CA3096N	3.95
CA3023H	3.25	CA3080H	1.25	CA3130H	1.39
CA3035H	2.49	CA3081N	2.00	CA3140H	1.25
CA3039H	1.35	CA3082N	2.00	CA3160H	1.25
CA3046N	1.30	CA3083N	1.60	CA3401N	.59
CA3059N	3.25	CA3086N	.85	CA3600N	3.50

CD–CMOS

CD4000	.39			CD 4098	2.49
CD4001	.39			CD4506	.75
CD4002	.39			CD4507	.99
CD4006	1.19	CD4041	1.49	CD4508	3.95
CD4007	.25	CD4042	.99	CD4510	1.39
CD4009	.49	CD4043	.89	CD4511	1.29
CD4010	.49	CD4044	.89	CD4512	1.49
CD4011	.39	CD4046	1.79	CD4514	3.95
CD4012	.25	CD4047	2.50	CD4515	2.95
CD4013	.49	CD4048	1.35	CD4516	1.49
CD4014	1.39	CD4049	.49	CD4518	1.79
CD4015	1.19	CD4050	.69	CD4519	.89
CD4016	.59	CD4051	1.19	CD4520	1.29
CD4017	1.19	CD4052	1.19	CD4526	1.79
CD4018	.99	CD4053	1.19	CD4528	1.79
CD4019	.49	CD4056	2.95	CD4529	1.95
CD4020	1.19	CD4059	9.95	CD4543	2.79
CD4021	1.39	CD4060	1.49	CD4562	11.95
CD4022	1.19	CD4066	.79	CD4566	2.79
CD4023	.29	CD4068	.39	CD4583	2.49
CD4024	.79	CD4069	.45	CD4584	.75
CD4025	.23	CD4070	.55	CD4723	1.95
CD4026	2.95	CD4071	.49	CD4724	1.95
CD4027	.69	CD4072	.49	MC14409	17.95
CD4028	.89	CD4073	.39	MC14410	18.95
CD4029	1.49	CD4075	.39	MC14411	15.95
CD4030	.49	CD4076	1.39	MC14412	15.95
CD4034	3.49	CD4078	.55	MC14419	7.95
CD4035	.99	CD4081	.39	MC14433	15.95
CD4040	1.49	CD4082	.39	MC14538	2.49
		CD4093	.99	MC14541	1.95

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LITRONIX Stick Display Sale

SALE!

MULTI-DIGIT REFLECTOR ARRAYS FOR CLOCKS

PART NUMBER/COLOR	CHAR HT (IN.)	POLARITY	DESCRIPTION SEGMENT/DIGIT	OVERALL SIZE Length x Height x Dpth	LIGHT OUTPUT (MCD) TYP	MIN	@mA	FORWARD VOLTAGE SEGMENT (V) I_f = 20mA TYP	MAX	CONTINUOUS FORWARD CURRENT PER SEGMENT (mA) MAX	PRICE	2 FOR SALE
DL-4500 (Red)	.50	C.C. MPX	With Colon and Auxiliary Indicators	3-3/16"x1-1/4"x5/16"	.8	.5	10	1.7	2.0	30	1.95	2/2.95
DL-4507 (Red)				3-1/16"x1"x5/16"	—	1.0					1.75	2/2.95
DLG-4507 (Grn)		C.C. non-MPX		3-3/16"x1"x5/16"	.8	.5					4.95	2/7.95
DL-4520A (Red)				3-3/16"x1"x5/16"							2.49	2/2.95

MULTI-DIGIT REFLECTOR ARRAYS

PART NUMBER/COLOR	CHAR HT (IN.)	POLARITY	DESCRIPTION SEGMENT/DIGIT	OVERALL SIZE	TYP	MIN	@mA	TYP	MAX	CURRENT (mA) MAX	PRICE	2 FOR SALE
DL-2300 (Red)	.30	C.C. MPX	7 Seg. 2-Digit RHDP	11/16" x 7/8" x 1/4"	2.5	1.1	20	1.7	2.0	30	.79	2/.99
DLG-2535 (Grn)	.50	C.A. MPX	9 Seg. 2 Digit	1-5/16"x1-1/2"x5/16"		2.5	20		3.5	25	.89	2/1.19
DL-4509 (Red)	.50	C.C. MPX	9 Seg. 4 Digit RHDP	2" x 1-5/16" x 5/16"	.8	.5	10	1.7	2.0	30	1.49	2/1.95
DL-3130 (Red)	1.0	C.A. MPX	7 Seg. 3 Digit RHDP	2-3/4"x1-13/16"x5/16"	1.5	1.0	10	3.4	4.0	30	2.25	2/3.49

LIMITED QUANTITY!

NATIONAL Stick Display Sale

LED NUMERIC ARRAYS

SALE!

PART NO	DIGIT SIZE (RED)	FORMAT	DRIVE Comm. Cathode/Comm. Anode	OVERALL SIZE	PRICE	
NSA166	.100 (9 Bubble Stick)	888888	C.C. 6 Digit Multiplexed	2"L x .72"H x .27"D	$ .59	2/.99
NSA198	.100 (9 Bubble Stick)	8.8.8.8.8.8.8.8.8.	C.C. 9 Digit Multiplexed	2"L x .72"H x .27"D	.69	2/.99
NSA298	.100 (9 Bubble Stick)	8.8.8.8.8.8.8.8.8.	C.C. 9 Digit Multiplexed	1.98"L x .72"H x .27"D	.69	2/.99
NSA1140	.100 (9 Bubble Stick)	88 88	C.C. 4 Digit Multiplexed	2"L x .72"H x .27"D	.49	2/.79
NSA1150	.100 (9 Bubble Stick)	8 88 88	C.C. 5 Digit Multiplexed	2"L x .72"H x .27"D	.49	2/.59
NSA1588	.140 (9 Bubble Stick)	8.8.8.8.8.8.8.8.	C.C. 8 Digit Multiplexed	2-3/8"L x .72"H x .27"D	.69	2/1.19
MULTI-DIGIT LED NUMERIC DISPLAYS						
NSN373	.3 No Decimal	88	C.C. 2 Digit Direct	.80"L x .80"H x .225"D	$ .69	2/.79
NSN374	.3 No Decimal	88	C.A. 2 Digit Direct	.80"L x .80"H x .225"D	.79	2/.99
NSN501	.5 No Decimal	88	C.A. 2 Digit Direct	1.40"L x 1.14"H x .32"D (7/16" pins)	.89	2/1.49
NSN502	.5 No Decimal	88	C.A. 2 Digit Direct	1.40"L x 1.14"H x .32"D (7/16" pins)	.89	2/1.49
NSN581	.5	8.8.	C.C. 2 Digit Multiplexed	1"L x 1.05"H x .28"D (7/16" pins)	.99	2/1.79
NSN583	.5	8.8.	C.C. 2 Digit Direct	1"L x 1.05"H x .28"D (5/8" pins)	.99	2/1.79
NSN781	.7	8.8.	C.C. 2 Digit Multiplexed	1.2"L x 1.25"H x .3"D	1.19	2/1.95
NSB2100	.3	88×88÷8888	C.C. 8 Digit (10 Spaces)	4"L x .60"H x .250"D	.75	2/.89
NSB3001	.3	8888	C.C. 4 Digit Multiplexed	1.59"L x .85"H x .25"D (7/16" pins)	.75	2/.89
NSB3382	.3	+1888	C.A. 3½ Digit Multiplexed	1.60"L x .80"H x .225"D	.99	2/1.49
NSB3411	.3	PM 88 88	C.C. 4 Digit – Colon/PM Indicator	1-9/16"L x 13/16"H x 3/16"D	.99	2/1.19
NSB3652	.3	•18 •88 88	C.C. 6 Digit – AM/PM, Failure Ind	3"L x 1.10"H x 7/32"D	2.95	2/3.95
NSB3854	.3	88888888	C.A. 8 Digit Multiplexed	3"L x 1-3/32"H x 3/16"D	2.95	2/3.95
NSB3881*	.3	8888	C.C. 4 Digit Multiplexed	1.59"L x .80"H x .225"D	2.95	2/4.95
NSB3882*	.3	8888	C.A. 4 Digit Multiplexed	1.58"L x .80"H x .225"D	2.95	2/4.95
NSB5382*	.5	+1888	C.A. 3½ Digit Multiplexed	1.99"L x 1.00"H x .28"D	3.49	2/5.95
NSB5441	.5	•88 88	C.C. 4 Digit – AM/PM, Colon Ind	3.00"L x 1.10"H x .282"D	2.95	2/3.95
NSB5881*	.5	8888	C.C. 4 Digit Multiplexed	1.99"L x 1.00"H x .280"D	3.49	2/5.95
NSB5882*	.5	8888	C.A. 4 Digit Multiplexed	1.99"L x 1.00"H x .280"D	3.49	2/5.95
NSB5918	.5	+8888	C.C. 3½ Digit Multiplexed	3.00"L x 1.10"H x .282"D	2.49	2/3.49
NSB5822	.5	88888	C.A. 5 Digit Multiplexed	3.00"L x 1.10"H x .282"D	2.95	2/3.49
NSB7923	.7	888888	C.C. 6 Digit Multiplexed	3.60"L x 1.35"H x .292"D (3/8" pins)	3.95	2/4.95

*Standard Stocked Items – only pin-out specifications available on non-stocked items.

COMPUTER GRADE CAPACITORS

1¢ SALE!

MFD	WVDC	PRICE	MFD	WVDC	PRICE	MFD	WVDC	PRICE
250	150	1.95	10,000	15	2.95	24,000	20	2.95
500	200	2.49	10,000	16	3.95	27,000	10	2.95
1,250	3	.99	11,000	19	4.95	32,500	25	4.95
1,500	25	1.95	11,000	55	5.49	40,000	25	5.95
1,500	50	2.95	11,000	60	5.95	43,000	10	5.95
2,000	10	2.95	13,000	16	2.95	50,000	20	7.95
2,250	100	3.95	14,000	13	2.95	52,000	20	5.95
2,300	33	2.95	14,000	35	3.95	55,000	15	5.95
2,500	15	2.95	18,000	10	3.95	58,000	20	5.95
3,000	25	1.95	20,000	20	2.95	65,000	10	7.95
3,600	40	3.95	20,000	55	3.95	73,800	5	7.95
4,500	50	3.95	21,000	15	3.95	80,000	15	9.95
5,500	25	4.49	23,000	7	1.95	90,000	10	8.95
6,100	40	2.49	23,000	10	2.95	160,000	10	8.95
6,600	50	4.95	23,000	20	3.95	200,000	3	12.95

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LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin LP	.17	.16	.15
14 pin LP	.20	.19	.18
16 pin LP	.22	.21	.20
18 pin LP	.29	.28	.27
20 pin LP	.34	.32	.30
22 pin LP	.37	.36	.35
24 pin LP	.38	.37	.36
28 pin LP	.45	.44	.43
36 pin LP	.60	.59	.58
40 pin LP	.63	.62	.61

SOLDERTAIL STANDARD (TIN)

	1-24	25-49	50-100
14 pin ST	.27	.25	.24
16 pin ST	.30	.27	.25
18 pin ST	.35	.32	.30
24 pin ST	.49	.45	.42
28 pin ST	.99	.90	.81
36 pin ST	1.39	1.26	1.15
40 pin ST	1.59	1.45	1.30

SOLDERTAIL (GOLD) STANDARD

	1-24	25-49	50-100
8 pin SG	.39	.35	.31
14 pin SG	.49	.45	.41
16 pin SG	.54	.49	.44
18 pin SG	.59	.53	.48
24 pin SG	.79	.75	.69
28 pin SG	1.10	1.00	.90
36 pin SG	1.65	1.40	1.26
40 pin SG	1.75	1.59	1.45

WIRE WRAP SOCKETS (GOLD) LEVEL #3

	1-24	25-49	50-100
8 pin WW	.59	.54	.49
10 pin WW	.69	.63	.58
14 pin WW	.79	.73	.67
16 pin WW	.85	.77	.70
18 pin WW	.99	.90	.81
20 pin WW	1.19	1.08	.99
22 pin WW	1.49	1.35	1.23
24 pin WW	1.39	1.26	1.14
28 pin WW	1.69	1.53	1.38
36 pin WW	2.19	1.99	1.79
40 pin WW	2.29	2.09	1.89

1/4 WATT RESISTOR ASSORTMENTS – 5%

ASST. 1	5ea.	10 Ohm 12 Ohm 15 Ohm 18 Ohm 22 Ohm 27 Ohm 33 Ohm 39 Ohm 47 Ohm 56 Ohm	50pcs.	$1.95
ASST. 2	5ea.	68 Ohm 82 Ohm 100 Ohm 120 Ohm 150 Ohm 180 Ohm 220 Ohm 270 Ohm 330 Ohm 390 Ohm	50pcs.	$1.95
ASST. 3	5ea.	470 Ohm 560 Ohm 680 Ohm 820 Ohm 1K 1.2K 1.5K 1.8K 2.2K 2.7K	50pcs.	$1.95
ASST. 4	5ea.	3.3K 3.9K 4.7K 5.6K 6.8K 8.2K 10K 12K 15K 18K	50pcs.	$1.95
ASST. 5	5ea.	22K 27K 33K 39K 47K 56K 68K 82K 100K 120K	50pcs.	$1.95
ASST. 6	5ea.	150K 180K 220K 270K 330K 390K 470K 560K 680K 820K	50pcs.	$1.95
ASST. 7	5ea.	1M 1.2M 1.5M 1.8M 2.2M 2.7M 3.3M 3.9M 4.7M 5.6M	50pcs.	$1.95
ASST. 8R		Includes Resistor Assts. 1-7 (350 pcs.)		$10.95 ea.

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INTERSIL

Part No.	Function	Price
7045IPI	CMOS Precision Timer	14.95
7045EV/Kit*	Stopwatch Chip, XTL	24.95
7106CPL	3½ Digit A/D (LCD Drive)	16.95
7106EV/Kit*	IC, Circuit Board, Display	34.95
7107CPL	3½ Digit A/D (LED Drive)	15.95
7107EV/Kit*	IC, Circuit Board, Display	29.95
7116CPL	3½ Digit A/D LCD Dis. HLD.	18.95
7117CPL	3½ Digit A/D LED Dis. HLD.	17.95
7201IDR	Low Battery Volt Indicator	2.25
7205IPG	CMOS LED Stopwatch/Timer	12.95
7205EV/Kit*	Stopwatch Chip, XTL	19.95
7206CJPE	Tone Generator	5.15
7206CEV/Kit*	Tone Generator Chip, XTL	12.95
7207AIPD	Oscillator Controller	6.50
7207AEV/Kit*	Freq. Counter Chip, XTL	13.95
7208IPI	Seven Decade Counter	17.95
7209IPA	Clock Generator	3.95
7215IPG	4 Func. CMOS Stopwatch CKT	13.95
7215EV/Kit*	4 Func. Stopwatch Chip, XTL	19.95
7216AIJI	8-Digit Univ. Counter C.A.	32.00
7216CIJI	8-Digit Freq. Counter C.A.	26.95
7216DIPI	8-Digit Freq. Counter C.C.	21.95
7217IJI	4-Digit LED Up/Down Counter	12.95
7218CIJI	8-Digit Univ. LED Drive	10.95
7224IPL	LCD 4½ Digit Up Counter DRI	11.25
7226AIJL	8-Digit Univ. Counter	31.95
7226AEV/Kit*	5 Function Counter Chip, XTL	74.95
7240IJE	CMOS Bin Prog. Timer/Counter	4.95
7242IJA	CMOS Divide-by-256 RC Timer	2.05
7250IJE	CMOS BCD Prog. Timer/Counter	6.00
7260IJE	CMOS BCD Prog. Timer/Counter	5.25
7555IPA	CMOS 555 Timer (8 pin)	1.45
7556IPD	CMOS 556 Timer (14 pin)	2.20
7611BCPA	CMOS Op Amp Comparator 5MV	2.25
7612BCPA	CMOS Op Amp Ext. Cmvr. 5MV	2.95
7621BCPA	CMOS Dual Op Amp Comp. 5MV	3.95
7631CCPE	CMOS Tri Op Amp Comp. 10MV	5.35
7641CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7642CCPD	CMOS Quad Op Amp Comp. 10MV	7.50
7660CPA	Voltage Converter	2.95
8038CCPD	Waveform Generator	4.95
8048CCPE	Monolithic Logarithmic Amp	21.60
8069CCQ	50ppm Band—GAP Volt Ref. Diode	2.50
8211CPA	Volt Ref/Indicator	2.95
8212CPA	Volt Ref/Indicator	2.95

74C

74C00	.39			74C221	1.95
74C02	.39	74C95	1.59	74C240	2.25
74C04	.39	74C107	1.89	74C244	2.25
74C08	.39	74C151	2.95	74C373	2.49
74C10	.39	74C154	3.95	74C374	2.59
74C14	.75	74C157	2.25	74C901	.69
74C20	.39	74C160	1.69	74C903	.69
74C30	.39	74C161	1.60	74C911	10.95
74C42	1.39	74C162	1.49	74C912	10.95
74C48	1.95	74C163	1.69	74C915	1.69
74C73	.79	74C164	1.59	74C917	10.95
74C74	.79	74C173	1.39	74C922	5.49
74C85	1.95	74C174	1.39	74C923	5.75
74C86	.99	74C175	1.19	74C925	7.50
74C89	6.95	74C192	1.69	74C926	7.50
74C90	1.29	74C193	1.69	80C95	.79
74C93	1.29	74C195	1.59	80C97	.79

LINEAR

LH0002CN	6.85			LM702H	.79
LM10CLH	4.50			LM703CN	.89
LM11CLH	4.75	LM340T-5	1.25	LM709N	.29
LH0070-OH	4.95	LM340T-12	1.25	LM710N	.79
TL071CP	.79	LM340T-15	1.25	LM711N	.79
TL072CP	1.39	LM341P-5	.75	LM723N	.69
TL074CN	2.49	LM341P-12	.75	LM733N	1.00
LH0082CD	35.80	LM341P-15	.75	LM739N	1.19
TL082CP	1.19	LM342P-5	.69	LM741CN	.35
TL084CN	2.19	LM342P-12	.69	MC1741SCG	3.00
LH0094CD	36.80	LM342P-15	.69	LM747N	.79
LM300H	.99	LM348N	1.25	LM748N	.59
LM301CN	.35	LM350K	5.75	LM1014N	2.75
LM302H	1.95	LF351N	.60	LM1310N	1.95
LM304H	1.95	LF353N	1.00	LM1458CN	.59
LM305H	.99	LF355N	1.10	LM1488N	1.25
LM307CN	.45	LF356N	1.10	LM1489N	1.25
LM308CN	1.00	LM358N	1.00	LM1496N	1.95
LM309H	1.95	LM359N	1.79	LM1556V	1.75
LM309K	1.25	LM370N	4.49	LM1800N	2.95
LM310CN	1.75	LM373N	3.25	LM1871N	5.49
LM311/CN	.90	LM377N	2.95	LM1872N	5.49
LM312H	2.49	LM380N	1.25	LM1877N-9	3.25
LM317MP	1.15	LM381N	1.95	LM1889N	3.20
LM317T	1.75	LM382N	1.79	LM1896N	1.75
LM317K	3.95	LM384N	1.95	LM2002T	1.49
LM318CN	1.95	LM386N-3	1.29	LM2877P	2.05
LM319N	1.95	LM387N	1.45	LM2878P	2.25
LM320K-5	1.35	LM389N	1.35	LM2896P-1	2.25
LM320K-12	1.35	LM392N	.69	LM3189N	2.95
LM320K-15	1.35	LF398N	4.00	LM3900N	.69
LM320T-5	1.25	LM399H	5.00	LM3905CN	1.25
LM320T-12	1.25	TL494CN	4.49	LM3909N	1.15
LM320T-15	1.25	TL496CP	1.75	LM3914N	3.95
LM323K	5.95	NE510A	6.00	LM3915N	3.95
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LM335Z	1.40	NE544N	4.95	RC4195TK	5.49
LM336Z	1.75	NE550A	1.30	LM4500A	3.25
LM337T	1.95	NE555V	.39	ICL8038B	4.95
LM337MP	1.15	LM556N	.99	LM13080N	1.29
LM338K	6.95	NE564N	3.95	LM13600N	1.49
LM339N	.99	LM565N	1.25	75138N	1.95
LM340K-5	1.35	LM566CN	1.95	75450N	.89
LM340K-12	1.35	LM567V	1.25	75451CN	.39
LM340K-15	1.35	NE570N	4.95	75492	.89

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22 pf	.08	.06	.05	.0047µF	.08	.06	.05
47 pf	.08	.06	.05	.01µF	.08	.06	.05
100 pf	.08	.06	.05	.022µF	.09	.07	.06
220 pf	.08	.06	.05	.047µF	.09	.07	.06
470 pf	.08	.06	.05	.1µF	.15	.12	.10

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07	.022mf	.13	.11	.08
.0022mf	.12	.10	.07	.047mf	.21	.17	.13
.0047mf	.12	.10	.07	.1mf	.27	.23	.17
.01mf	.12	.10	.07	.22mf	.33	.27	.22

+20% DIPPED TANTALUMS (Solid) CAPACITORS

.1/35V	.39	.34	.29	1.5/35V	.41	.37	.29
.15/35V	.39	.34	.29	2.2/35V	.51	.45	.34
.22/35V	.39	.34	.29	3.3/25V	.53	.47	.37
.33/35V	.39	.34	.29	4.7/25V	.63	.56	.45
.47/35V	.39	.34	.29	6.8/25V	.79	.69	.55
.68/35V	.39	.34	.29	15/25V	1.39	1.25	.95
1.0/35V	.39	.34	.29	22/6V	.79	.69	.55

MINI. ALUMINUM ELECTROLYTIC CAPACITORS

Axial	1-99	100-499	500+	Radial	1-99	100-499	500+
.47/50V	.16	.14	.10	.47/25V	.15	.13	.12
1.0/50V	.19	.16	.12	.47/50V	.16	.14	.13
3.3/50V	.17	.15	.11	1.0/16V	.15	.13	.12
4.7/25V	.18	.15	.11	1.0/25V	.16	.14	.13
10/25V	.18	.15	.11	1.0/50V	.17	.15	.14
10/50V	.19	.16	.12	4.7/16V	.15	.13	.12
22/25V	.19	.16	.12	4.7/25V	.16	.14	.13
22/50V	.24	.20	.18	4.7/50V	.17	.15	.14
47/25V	.25	.21	.19	10/16V	.15	.13	.12
47/50V	.29	.25	.23	10/25V	.16	.14	.13
100/25V	.28	.24	.22	10/50V	.17	.15	.14
100/50V	.41	.37	.34	47/50V	.25	.21	.19
220/25V	.39	.34	.33	100/16V	.21	.17	.14
220/50V	.49	.45	.41	100/25V	.25	.23	.21
470/25V	.54	.49	.45	100/50V	.37	.34	.31
1000/16V	.79	.69	.61	220/16V	.25	.21	.19
2200/16V	.89	.79	.69	470/25V	.35	.31	.27

UTIC MINI STEREO FM RECEIVER WITH HEADPHONES

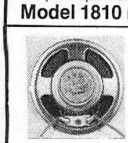


For Joggers, Cyclists, and Skaters!

FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional black soft carrying case & shoulder strap. Belt clip (hands free). Operates on 3 AA cell batteries (not incl.). Compact size: 3½" x 4⅞" x 1". Wt. 6 oz.

Model 1810 List Price $89.95 ..... **$29.95**

SPEAKERS





	1	2-9
Part # A0201	1.25	.99

2¼" Round — 8 Ohm .25 Watt (4" Leads) Size: 2¼" x ¾"

	1	2-9
Part # SF-25016	1.39	1.25

2½" Square — 16 Ohm .25 Watt (4 mount. holes) Large Ceramic Magnet Size: 2⅝" x 2⅝" x ¾"



National Semiconductor RAM SALE

STATIC RAMS

MM2114N-2 4K (200NS) ..... **$2.49 each**
(8 EACH $16.95/lot) (100 EACH $195.95/lot)

MM2114N-2L 4K (200NS) Low Power .... **$2.95 each**
(8 EACH $19.95/lot) (100 EACH $225.00/lot)

MM2147N 4K (70NS) ..... **$4.95 each**
(8 EACH $34.95/lot) (100 EACH $419.95/lot)

MM6116P-4 16K (200NS) ..... **$14.95 each**
(8 EACH $99.95/lot) (100 EACH $1195.00/lot)

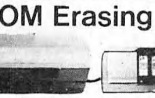
DYNAMIC RAMS

MM4164N-20 64K (200NS) ..... **$14.95 each**
(8 EACH $99.95/lot) (100 EACH $1195.00/lot)

MM5290N-2 16K (150NS) 4116 ..... **$2.95 each**
(8 EACH $19.95/lot) (100 EACH $225.00/lot)

MM5290N-4 16K (250NS) 4116 ..... **$1.95 each**
(8 EACH $14.95/lot) (100 each $175.00/lot)

EPROM Erasing Lamp

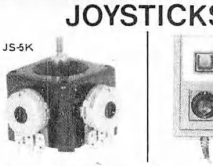


- Erases 2708, 2716, 1702A, 5203Q, 5204Q, etc.
- Erases up to 4 chips within 20 minutes.
- Maintains constant exposure distance of one inch.
- Special conductive foam liner eliminates static build-up.
- Built-in safety lock to prevent UV exposure.
- Compact — only 7-5/8" x 2-7/8" x 2"
- Complete with holding tray for 4 chips.

UVS-11EL Replacement Bulb $16.95

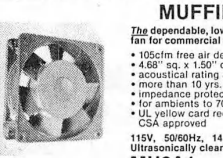
UVS-11E **$79.95**

JOYSTICKS



JS-5K	5K Linear Taper Pots $5.25
JS-100K	100K Linear Taper Pots $4.95
JVC-40	40K (2) Video Controller in case ... $4.95

MUFFIN® FAN



***The* dependable, low cost, largest selling fan for commercial cooling applications.**

- 105cfm free air delivery
- 4.68" sq. x 1.50" depth. Weight - 17 oz.
- acoustical rating as low as NC-38
- more than 10 yrs. cont. duty at 10°C
- impedance protected
- for ambients to 70°C
- UL yellow card recognized & CSA approved

115V, 50/60Hz, 14 Watts, 105cfm — Ultrasonically cleaned & tested.

MU2A1 ..... $9.95 ea.

NEW! JE215 Adjustable Dual Power Supply

General Description: The JE215 is a Dual Power Supply with independent adjustable positive and negative output voltages. A separate adjustment for each of the supplies provides the user unlimited applications for IC current voltage requirements. The supply can also be used as a general all-purpose variable power supply.



FEATURES:
- Adjustable regulated power supplies, pos. and neg. 1.2VDC to 15VDC.
- Power Output (each supply): 5VDC @ 500mA, 10VDC @ 750mA, 12VDC @ 500mA, and 15VDC @ 175mA.
- Two, 3-terminal adj. IC regulators with thermal overload protection.
- Heat sink regulator cooling
- LED "on" indicator
- Printed Board Construction
- 120VAC input
- Size: 3-1/2"w x 5-1/16"L x 2"H

JE215 Adj. Dual Power Supply Kit (as shown) .. $24.95

(Picture not shown but similar in construction to above)
JE200 Reg. Power Supply Kit (5VDC, 1 amp) .. $14.95
JE205 Adapter Brd. (to JE200) ±5,±9 & ±12V. $12.95
JE210 Var. Pwr. Sply. Kit, 5-15VDC, to 1.5amp. $19.95

MICROPROCESSOR COMPONENTS

8080A/8080A SUPPORT DEVICES

INS8080A-4	CPU	4.95
DP8212	8-Bit Input/Output	3.25
DP8214	Priority Interrupt Control	5.95
DP8216	Bi-Directional Bus Driver	3.49
DP8224	Clock Generator/Driver	3.95
DP8226	Bus Driver	3.49
DP8228	System Controller/Bus Driver	4.95
DP8238	System Controller	5.95
INS8243	I/O Expander for 48 Series	9.95
INS8250	Asynchronous Comm. Element	16.95
DP8251	Prog. Comm. I/O (USART)	6.95
DP8253	Prog. Interval Timer	8.95
DP8255	Prog. Peripheral I/O (PPI)	5.95
DP8257	Prog. DMA Control	9.95
DP8259	Prog. Interrupt Control	9.95
DP8275	Prog. CRT Controller	39.95
DP8279	Prog. Keyboard/Display Interface	9.95
DP8303	System Timing Element	6.95
DP8304	8-Bit Bi-Directional Receiver	3.95
DP8307	8-Bit Bi-Directional Receiver	3.95
DP8308	8-Bit Bi-Directional Receiver	3.95
DP8310	Octal Latched Peripheral Driver	5.25
DP8311	Octal Latched Peripheral Driver	5.25

6800/6800 SUPPORT DEVICES

MC6800	MPU	7.95
MC6802CP	MPU with Clock and RAM	14.95
MC6810AP1	128x8 Static RAM	4.95
MC6821	Peripheral Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	17.95
MC6830L8	1024x8-Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	6.95
MC6852	Synchronous Serial Data Adapter	6.95
MC6860	0-600bds Digital MODEM	10.95
MC6862	2400 bbds Modulator	12.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS

Z80 (780C)	CPU (MK3880N) (2MHz)	11.95
Z80A (780-1)	CPU (MK3880N-4) (4MHz)	13.95
CDP1802	CPU	19.95
2650	MPU	16.95
IDM2901ADC	CPU—4-Bit Slice (Com. Temp. Grade)	19.95
MC56502	MPU w/Clock (65K Bytes Memory)	11.95
INS8035N-6	MPU—8-Bit (6MHz)	7.95
INS8039N-6	CPU—Sgl. Chip 8-Bit (128bytes RAM)	9.95
INS8040N-6	CPU (256 Bytes RAM)	24.95
INS8070N	CPU—64 Bytes RAM	24.95
INS8073N	CPU w/Basic Micro Interpreter	29.95
P8085	CPU	9.95
TMS9900JL	MPU—16-Bit	39.95
1173AN-1	30 Tune Musical MPU Chip	8.95

SHIFT REGISTERS

MM500H	Dual 25-Bit Dynamic	.50
MM503H	Dual 50-Bit Dynamic	.50
MM506H	Dual 100-Bit Static	.50
MM510H	Dual 64-Bit Accumulator	.50
MM1402N	256-Bit Dynamic	2.95
MM5013N	1024-Bit Dynamic/Accumulator	1.95
MM5016H	500/512-Bit Dynamic	1.95
MM5034N	Octal 80-Bit	9.95
MM5035N	Octal 80-Bit	9.95
2504V (1404A)	1024-Bit Dynamic	1.95
2518N	Hex 32-Bit Static	3.95
2520V	Dual 132-Bit Static	2.95
2524V	512-Bit Dynamic	.99
2525V	1024-Bit Dynamic	2.95
2527V	Dual 256-Bit Static	2.95
2528V	Dual 250-Bit Static	4.00
2529V	Dual 240-Bit Static	4.00
2532N	Quad 80-Bit Static	5.95
3341PC	Fifo (Dual 80)	6.95

DATA ACQUISITION

AF100-1CN	Universal Active Filter 2.5%	5.95
AF121-1CJ	Touch Tone Low Band Filter	19.95
AF122-1CJ	Touch Tone High Band Filter	19.95
LM308CH	Super Gain Op Amp	1.15
LM334Z	Constant Current Source	1.30
LM335Z	Temperature Transducer	1.40
LF356N	JFET Input Op Amp	1.10
LF398N	Sample & Hold Amplifiers	3.95
LM399H	Temp. Comp. Prec. Ref. (.5ppm/C°)	5.00
ADC0804LCN	8-Bit A/D Converter (1 LSB)	4.95
DAC0806LCN	8-Bit D/A Converter (0.78% Lin.)	2.25

DATA ACQUISITION (CONTINUED)

ADC0809CCN	8-Bit A/D Converter (8-Ch. Multi.)	5.25
ADC0817CCN	8-Bit A/D Converter (16-Ch. Multi.)	10.95
DAC1000LCN	10-Bit D/A Conv. Micro. Comp. (0.05%)	13.95
DAC1008LCN	10-Bit D/A Conv. Micro. Comp. (0.20%)	8.95
DAC1020LCN	10-Bit D/A Converter (0.05% Lin.)	8.49
DAC1022LCN	10-Bit D/A Converter (0.20% Lin.)	5.95
DAC1222LCN	12-Bit D/A Converter (0.20% Lin.)	9.95
CD4051N	8-Channel Multiplexer	1.19
AY-5-1013	30K BAUD UART	6.95

RAM'S

1101	256x1 Static	1.49
1103	1024x1 Dynamic	.99
2101 (8101)	256x4 Static	3.95
2102	1024x1 Static	1.75
21L02	1024x1 Static	1.95
2111 (8111)	256x4 Static	3.95
2112	256x4 Static MOS	4.95
2114	1024x4 Static 450ns	2.25
2114L	1024x4 Static 450ns Low Power	2.49
2114-2	1024x4 Static 200ns	2.49
2114L-2	1024x4 Static 200ns Low Power	2.95
745200	256x1 Static	6.95
4116N-4 (UPD416)	16K Dynamic 250ns (MM5290N-4)	1.95
4164N-3	64K Dynamic 200ns	14.95
MM2147N	4096x1 Fast 70ns	4.95
5101	256x4 Static	7.95
MM5261	1024x1 Dynamic Fully Decoded	.99
MM5262	2Kx1 Dynamic	.49
MM5280/2107	4096x1 Dynamic	4.95
MM5290N-2 (4116)	16K Dynamic 150ns (UPD416C-3)	2.95
MM5298J-3A	8K Dyn. 200ns (lower ½ of MM5299J)	1.95
HM6116-4	16K (2Kx8) Static 200ns	14.95
82S25	64 Bit RAM (16x40C)	3.49
UPD414/MK4027	64K Dynamic 16-pin	4.95
TMS4044-45NL	4K Static	9.95
TMS4045	1024x4 Static	9.95

PROMS/EPROMS

1702A	2K UV Erasable PROM	5.95
2708	8K EPROM	2.95
TMS2716	16K EPROM (+5V, +5V, +12V)	9.95
2716Intel(2516)TI	16K EPROM (Single +5V)	8.95
2732Intel TI	32K EPROM	17.95
2758	8K EPROM (450ns) (Single +5V)	7.49
2764Q	64K EPROM (Hitachi HN462764)	49.95
5203	2048 PROM	14.95
82S23(74S188)	32x8 PROM (Open Collector)	3.95
82S115	4096 Bipolar PROM	14.95
82S123(74S288)	32x8 Tri-State Bipolar PROM	3.95
82S185	8K PROM	16.95

— Over 30 More PROMS Listed in Our Catalog —

ROM'S

2513(2140)	Character Generator (Upper Case)	9.95
2513(3021)	Character Generator (Lower Case)	9.95

NMOS READ ONLY MEMORIES

MCM66710P	128x9x7 ASCII Shifted w/Greek	13.50
MCM66740P	128x9x7 Math Symbol & Pictures	13.50
MCM66750P	128x9x7 Alpha, Control Char. Gen.	13.50

MICROPROCESSOR MANUALS

M-Z80	User Manual	7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

SPECIAL FUNCTION

DS0025CN	Dual MOS Clock Driver (SMZ)	3.50
DS0026CN	Dual MOS Clock Driver (SMZ)	1.95
INS1791N-1	Floppy Disc Controller	24.95
INS2631N	Communication Chip	19.95
MM58167N	Microprocessor Real Time Clock	8.95
MM58174N	Microprocessor Compatible Clock	11.95
COP402N	Microcontroller with 64-Digit RAM and Direct LED Drive	6.95
COP402MN	Microcontroller with 64-Digit RAM and Direct LED Drive w/N Buss Int.	7.49
COP476N	32-Seg. VAC Fluor. Driver (20-pin pkg.)	3.25

TELEPHONE/KEYBOARD CHIPS

AY-5-9100	Push Button Telephone Dialer	14.95
AY-5-9200	Repertory Dialer	14.95
AY-5-9500	CMOS Clock Generator	4.95
AY-5-2376	Keyboard Encoder (88 keys)	11.95
HD165-5	Keyboard Encoder (16 keys)	7.95
74C922	Keyboard Encoder (16 keys)	5.49
74C923	Keyboard Encoder (20 keys)	5.75
MM53190N	Push Button Pulse Dialer	7.95
MM57493N	96/144-Key Serial Keyboard Encoder	8.95



EECO Rocker DIP Switch — "Mini-Dip™ 2400 Series

THE MOST UNIQUE DIP SWITCH AVAILABLE!

MINI-DIP is designed to retrofit all major brands of Dip switches. Unique features include locking rod design to prevent accidental actuation and gold self-wiping contact. One-piece housing and press-fit terminals prevent contamination. 2-10 station Form "A" and 1-5 station Form "C."

- Terminals on .100 x .300 (2.54 x 7.62) centers • PCB or dip socket mountable • Positive cleaning/wiping action with gold contact • Total seal and bottom seal

2400-10

Part No.	Pos.	Configuration	Socket	Price
2400-2	2	12	8 pin	.79 - 10/ 6.95
2400-3	3	123	8 pin	.89 - 10/ 7.95
2400-4	4	1234	8 pin	.99 - 10/ 8.95
2400-ABCD	4	ABCD	8 pin	.99 - 10/ 8.95
2400-5C	6	C5432 1	14 pin	1.09 - 10/ 9.95
2400-6	6	123456	14 pin	1.09 - 10/ 9.95
2400-7	7	1234567	14 pin	1.19 - 10/10.95
2400-8	8	12345678	16 pin	1.29 - 10/11.95
2400-9	9	123456789	18 pin	1.39 - 10/12.95
2400-10	10	0123456789	20 pin	1.49 - 10/13.95

GRAB BAG SPECIALS



GB180 (Pictured Above)

CAPACITORS

Part No.	Description	Price
GB100	100 each Ceramic Disc (10pf–1mf)	$2.00
GB101	50 each Mylar	4.00
GB102	60 each Electrolytics	4.00
GB103	40 each Tantalum (tubular & dipped)	4.00
GB176	40 each Dipped Mica (short-lead) @ 100-500V	4.00

INTEGRATED CIRCUITS

GB108	50 each TTL Series – marked (7400, 74107, 74123, etc.)	$4.00
GB109	30 each Linear – marked (LM301, 307, 741, 308, etc.)	4.00
GB148	30 each Exar – marked (XR2206, 1310, 4136, etc.)	4.00
GB150	20 each Shift Registers – marked (2510, 2518, 2522, 2533, etc.)	4.00
GB157	50 each DTL Series – marked (DM930, 932, 936, 946, etc.)	3.00
GB158	6 pcs. Positive Voltage Regulators (TO-3 case) (7805, 06, 12, 15, 18, 24, etc.) Linear marked	4.25
GB159	6 pcs. Negative Voltage Regulators (TO-3 case) (7905, 06, 12, 15, 18, 24, etc.) Linear marked	4.00
GB170	25 each Assorted 74LS TTL Series	4.00
GB172	10 pcs. 78M Positive Volt. Reg. (TO-5 case) (78M05, 8, 12, 15, 20, 24, etc.) Linear marked	5.00

LEDS – LAMPS – READOUTS

GB110	100 each Assorted LEDs (colors & sizes) (XC556, XC526, etc.)	$6.00
GB111	40 each NE-2 Neon Type Lamps	3.00
GB112	20 ea. Multiple Readouts, calculators, clocks, timers, LEDs to Panaplex – new, used and rejects	4.00
GB162	50 each 7 Segment Displays (various colors and sizes)	5.00

POTENTIOMETERS

GB113	30 each Miniature Trimmers (100 ohm 1 Meg)	$4.00
GB134	24 each 3/8" square single-turn PC Mount (untested – 10 ohm to 500 ohm) marked	3.00
GB135	24 each 3/8" square single-turn PC Mount (untested – 1K to 50K) marked	3.00
GB136	24 each 3/8" square single-turn PC Mount (untested – 100K to 5 Meg) marked	3.00
GB173	100 ea. 3/8" sq. single-turn (U Test & Sort)	5.00
GB174	25 ea. ¾ watt thumbwheel single-turn (500 ohm-5 Meg)	2.00

DIODES

GB171	80 each Assorted Germanium (IN34, IN68, IN270)	$2.00
GB107	100 each Silicon (IN914/IN4148)	2.00
GB164	200 each marked, unmarked rectifiers & zeners	2.00
GB175	100 ea. 1 amp. 2 amp (cathode band) silicon rectifiers	4.00

RESISTORS

Part No.	Description	Price
GB116	200 each 1/4 watt resistor assortment	$2.00
GB117	200 each 1/2 watt resistor assortment	2.00
GB118	30 ea. Wire Wound 5,10,20W (1-100 ohm)	4.00
GB194	100 each 1 and 2 watt resistor assortment	2.00
GB178	500 each 1/4, 1/2, 1 watt (metal/carbon/wirewd) resistors	4.00

SWITCHES

GB120	25 each Miniature slide	$3.00
GB122	20 ea. Reed relays with coil and magnet – glass tube	5.00
GB165	40 asst. toggle, rocker, pushbutton	10.00
GB179	20 each Dip Switches (asst. positions)	9.95

HARDWARE

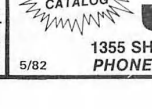
GB139	40 each Terminal Strips – assorted (solder and screw types (3 to 8 terminals)	$3.00
GB140	150 each Spacers, standoff, insulators (metal, nylon and plastic)	2.00
GB141	200 each Washers and Spacers (nylon and teflon)	2.00
GB142	50 ea. Chassis mounting feet (rubber and plastic)	2.00
GB144	200 each Solder lugs (small)	2.00
GB145	100 each Lugs – crimp on (some insulated)	2.00
GB146	100 each Grommets, cord strain reliefs and hole plugs	3.00
GB147	500 each Hardware mix (nuts, bolts, screws, lugs)	5.00
GB166	48 Threaded metal and plastic spacers (¼-2" long)	2.00
GB167	200 pcs. sheet metal and metal tapping screws	2.00
GB168	200 pcs. angle bars, clip insulators, etc.	3.00
GB169	100 pcs. tie wraps and harness clips (3-6")	3.00
GB180	100 pcs. Rubber/Silicone tubing, asst. sizes and colors	9.95

MISCELLANEOUS

GB123	30 each Heat Sinks – assorted sizes	$3.00
GB124	6 each assorted calculator-type keyboards	5.00
GB126	50 each Opto-Isolators – HL1 Series (untested)	2.00
GB127	100 each Transistors – plastic and power	3.00
GB128	30 each Toroid Cores – iron and tape	3.00
GB129	50 each Photo Transistors (LPT)	4.00
GB130	1 each Tape Drive – 6V motor with read/write erase head and 2 cassette tapes (no amplifier)	5.00
GB131	30 each 8" shrink tubing, asst. sizes and colors	4.00
GB137	50 each Chokes, coils and inductors (molded and miniature)	3.00
GB138	2 each Speakers, 2¼", 8 ohm, 1/4 watt	1.95
GB155	300 each mixed resistors, capacitors, diodes, transistors, chokes	3.00
GB160	Printed Circuit Board – Contains 50 TTL parts components on each board	2.00
GB163	30 ea. Sockets (Asst. IC and transistor)	4.00
GB177	200 each 1" Shrink tubing, asst. colors and sizes	3.00

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6% Sales Tax
Postage — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sale Flyer!

Spec Sheets — 25¢
Send 88¢ Postage for your
***FREE* 1982 JAMECO CATALOG**
Prices Subject to Change



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30009	**Intersil Data Book** (1074 pages)	$6.95
010400	**Intel Component Data Catalog** Full data sheets for Intel's products incl. memory devices, microproc., peripherals & indust./mil. products (1328 pages)	$10.00
205610	**Intel Peripheral Design Handbook** Full data sheets, appl. notes for Intel peripheral device components (644 pages)	$7.50

AC and DC Wall Transformers



With Universal Plug and 9V Battery Snap

Selective voltages: 6,9,12VDC. Polarity selection (+/-). six-foot line from adapter to plugs — six-inch line from adapter to battery snap. 120V/60Hz. 300mA.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12VAC 250mA	$3.95
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AC1000	117V/60Hz	12VAC 1 amp	$5.95
AC1700	117V/60Hz	9VAC 1.7 amp	$3.95
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DC6912 (above)	120V/60Hz	6,9,12VDC 300mA	$9.95
DV9200	117V/60Hz	9VDC 200mA	$3.25
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DC1200	120V/60Hz	12VDC 300mA	$3.95

CONNECTORS



DB25P	D-Subminiature Plug $2.95
DB25S	D-Subminiature Socket $3.50
D20418-2	Screw Lock Hdwr, (2) DB25S/P 2/$.99
DB51226	Cover for DB25P/S $1.75
22/44SE	P.C. Edge (22/44 Pin) $2.95
UG88/U	BNC Plug $1.79
UG89/U	BNC Jack $3.79
UG175/U	UHF Adapter ..... $ .49
SO239	UHF Panel Recp. $1.29
PL258	UHF Adapter $1.60
PL259	UHF Plug $1.60
UG260/U	BNC Plug $1.79
UG1094/U	BNC Bulkhead Recp. ... $1.29

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K
Kit comes complete with:

- **8 ea. MM5290 (UPD416/4116) 16K Dyn. Ram (*ns)**
- **Documentation for conversion**

TRS-16K2 *150ns 19.95
TRS-16K3 *200ns 16.95
TRS-16K4 *250ns 14.95

KEYBOARDS



Datanectics 74-Key Keyboard

Uses EA 20134 Chip (Electronic Arrays). Size: 16¾"L x 5½"W x 1-3/8"H. White, black, blue, grey key caps. (No Data Sheet) —

Part No. KB354 ..... $29.95 ea.



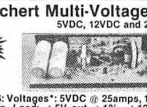
Micro Switch 69-Key Keyboard

Uses AMI SW20350K Chip. Size: 16-3/8"L x 5¼"W x 1-5/8"H Metal Frame. Light & dark grey key caps (No Data Sheet)

Part No. KB69SD12-2 ..... $19.95 ea.

Boschert Multi-Voltage Power Supply

5VDC, 12VDC and 24VDC



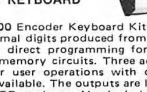
FEATURES: Voltages*: 5VDC @ 25amps, 12VDC @ 4amps, & 24VDC @ 4amps. Reg. Load: +5V out ±1%, +12 & 24V out ±5% (20-100% load). Overvolt. & overcurr. protection. 115 or 230VAC input. Wt. 4 lbs. Size: 4.95" x 2.50" x 15.00"
***Total average output shall not exceed 200 watts.**

General Description: The "Boschert" Power Supply was originally designed for application with ITT Advance Terminal Controller (ATC). This open frame switching power supply provides user with high current requirements common in use with computer systems. Its compact size provides versatility for mounting into electronic enclosures. Each supply has 6 threaded fasteners (pem nut type) for mounting. Specification requirements to be used with ATC enclosed.

Part No. 200-3010 ..... $69.95 each
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JE600 Hexadecimal Encoder Kit

FULL 8-BIT LATCHED OUTPUT 19-KEY KEYBOARD



The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation. Size: 3½"H x 8¾"W x 8¾"D

JE600/DTE-HK (After assembled as pictured above) **$99.95**

JE600 Kit 19-Key Hexadec. Keyboard, PC Board & Cmpnts. (no case) .. **$59.95**
K19 19-Key Keyboard (Keyboard only) **$14.95**
DTE-HK (case only —3½"H x 8¾"W x 8¾"D) **$44.95**

See List of Advertisers on page 130

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STATIC RAM

*21L02-1KX1 250 n.s.
Low Power ..... .95

2114L-3 1KX4 300 n.s.
Low Power 2.75 8/17.95

HM6116P-4-2KX8 + 5v-200 n.s.
CMOS Low Power 2716
Style Pin Out 13.50 8/95.00

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Retention 2 Volts - 22 Pin - 200 n.s.
Typ. - 5V - Very Low Power .. 1.50

6514-J-5 1KX4-CMOS Super Low
Power 350 n.s. Similar to 2114
Same Pin Out 2.95

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22 Pin 2.50

TMM2016-2KX8 + 5v-NMOS
200 n.s. - 2716 Style Pin
Out 13.50 8/95.00

MK4104J-4 250NS
4K x 1 STATIC 18 PIN CERAMIC
Computer Mfg. Surplus. PRIME. Fully Static. Easy to Use. Has Same Pin Out as TMS4044, but slightly different timing. With Specs. (Mostek)
8 for 12.00 32 for 39.95
VERY LOW POWER!

DYNAMIC RAM

2107B-4 (MM5280N-5)
4KX1 22 Pin 1.59

4027-4KX1-250 n.s. 1.75

*4116-16KX1-300 n.s. 8/12.95

*4116-16KX1-200 n.s. 8/15.95

4164- +5v 64K 12.95 8/95.00

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262.144 Khz	1.10	9.90000 Mhz	1.25
300.000 Khz	1.25	10.69425 Mhz	2.49
4444.000 Khz	1.25	10.695000 Mhz	1.59
2.000000 Mhz	2.49	11.088 Mhz	1.59
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8216	Buffer	1.95
8251	USAR	4.95
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7805	.99	7905	.99
7812	.99	7912	.99
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7824	.99	7924	.99

LM317T - To 220 ..... 1.75
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LAS 1412-+12v-3A To-3 ..... 3.95 3/10.00

74LS

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7406	.19	74125	.49
7408	.19	74154	1.19
7410	.19	74175	.79
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*Asterik Denotes Super Specials

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2708 1KX8 450 n.s. 2.95
27A08 1KX8 350 n.s. 3.95
*2716 2KX8+5v 450 n.s. 5.95
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Low Profile SOLDER TAIL

8 Pin	13/1.00	20 Pin	7/1.00
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BUY $10 GET $1.00 — FREE CHOICE

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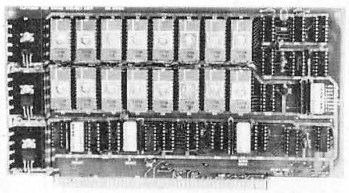
AMD2901-4 Bit Slice 7.95
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TERMS: Add $1.50 postage, we pay balance. Orders over $50.00 add 85¢ for insurance. No C.O.D. Texas Res. add 5% Tax. 90 Day Money Back Guarantee on all items. All items subject to prior sale. Prices subject to change without notice. Foreign order - U.S. funds only. We cannot ship to Mexico. Countries other than Canada, add $3.50 shipping and handling.

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ALL SALES ARE MADE SUBJECT TO THE TERMS OF OUR 90 DAY LIMITED WARRANTY. A COPY OF THIS WARRANTY IS AVAILABLE FREE, ON REQUEST.

32K S-100 EPROM CARD
NEW!



$79.95 KIT

USES 2716's

Blank PC Board - $34

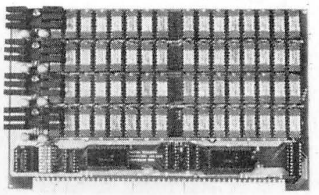
ASSEMBLED & TESTED ADD $30

SPECIAL: 2716 EPROM's (450 NS) Are $9.95 Ea. With Above Kit.

KIT FEATURES:
1. Uses +5V only 2716 (2Kx8) EPROM's.
2. Allows up to 32K of software on line!
3. IEEE S-100 Compatible.
4. Addressable as two independent 16K blocks.
5. Cromemco extended or Northstar bank select.
6. On board wait state circuitry if needed.
7. Any or all EPROM locations can be disabled.
8. Double sided PC board, solder-masked, silk-screened.
9. Gold plated contact fingers.
10. Unselected EPROM's automatically powered down for low power.
11. Fully buffered and bypassed.
12. Easy and quick to assemble.

32K SS-50 RAM

$259.95 KIT



For 2MHZ Add $10

Blank PC Board $50

For SWTPC 6800 - 6809 Buss

Support IC's and Caps $19.95

Complete Socket Set $21.00

Fully Assembled, Tested, Burned In Add $30

At Last! An affordable 32K Static RAM with full 6809 Capability.

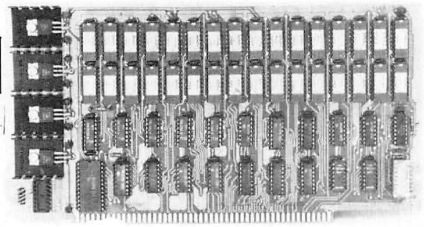
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1. **Uses proven low power 2114 Static RAMS.**
2. **Supports SS50C - EXTENDED ADDRESSING.**
3. **All parts and sockets included.**
4. **Dip Switch address select as a 32K block.**
5. **Extended addressing can be disabled.**
6. **Works with all existing 6800 SS50 systems.**
7. **Fully bypassed. PC Board is double sided, plated thru, with silk screen.**

16K STATIC RAM KIT-S 100 BUSS

PRICE CUT!

$149.95 KIT

FOR 4MHZ ADD $10



KIT FEATURES:
1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 1.5 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA-$33

LOW PROFILE SOCKET SET-$12

SUPPORT IC'S & CAPS-$19.95

ASSEMBLED & TESTED-ADD $35

OUR #1 SELLING RAM BOARD!

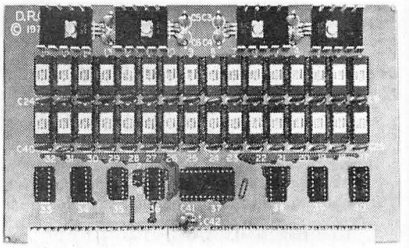
16K STATIC RAM SS-50 BUSS

PRICE CUT!

$139.95 KIT

FULLY STATIC!

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FOR SWTPC 6800 BUSS!

ASSEMBLED AND TESTED - $35

KIT FEATURES:
1. Addressable on 16K Boundaries
2. Uses 2114 Static Ram
3. Fully Bypassed
4. Double sided PC Board. Solder mask and silk screened layout
5. All Parts and Sockets included
6. Low Power: Under 1.5 Amps Typical

BLANK PC BOARD—**$35** COMPLETE SOCKET SET—**$12**
SUPPORT IC'S AND CAPS—**$19.95**

NEW! NEW!

STEREO! S-100 SOUND COMPUTER BOARD

At last, an S-100 Board that unleashes the full power of two unbelievable General Instruments AY3-8910 NMOS computer sound IC's. Allows you under total computer control to generate an infinite number of special sound effects for games or any other program. Sounds can be called in BASIC, ASSEMBLY LANGUAGE, etc.

COMPLETE KIT! **$84.95** (WITH DATA MANUAL)

BLANK PC BOARD W/DATA $31

KIT FEATURES:
* TWO GI SOUND COMPUTER IC'S.
* FOUR PARALLEL I/O PORTS ON BOARD.
* USES ON BOARD AUDIO AMPS OR YOUR STEREO.
* ON BOARD PROTO TYPING AREA.
* ALL SOCKETS, PARTS AND HARDWARE ARE INCLUDED.
* PC BOARD IS SOLDERMASKED, SILK SCREENED, WITH GOLD CONTACTS.
* EASY, QUICK, AND FUN TO BUILD. WITH FULL INSTRUCTIONS.
* USES PROGRAMMED I/O FOR MAXIMUM SYSTEM FLEXIBILITY.

Both Basic and Assembly Language Programming examples are included.

SOFTWARE:

SCL™ is now available! Our Sound Command Language makes writing Sound Effects programs a SNAP! SCL™ also includes routines for Register-Examine-Modify, Memory-Examine-Modify, and Play-Memory. SCL™ is available on CP/M* compatible diskette or 2708 or 2716. Diskette - **$24.95** 2708 - **$19.95** 2716 - **$29.95.** Diskette includes the source. EPROM'S are ORG at E000H. **(Diskette is 8 Inch Soft Sectored)**

SPECIAL PURCHASE!

UART SALE!

TR1602B — SAME AS TMS6011, AY5-1013, ETC. 40 PIN DIP

TR1602B

$2.95 EACH **4 For $10.00**

CRT CONTROLLER CHIP

SMC #CRT 5037. PROGRAMMABLE FOR 80 x 24, ETC. VERY RARE SURPLUS FIND. WITH PIN OUT. $12.95 EACH.

4K STATIC RAM

National Semi. MM5257. Arranged 4K x 1. +5V, 18 PIN DIP. A Lower Power, Plug in Replacement for TMS 4044. 450 NS. Several Boards on the Market Will Accept These Rams. SUPER SURPLUS PURCHASE! **PRIME NEW UNITS!**

8 FOR $16 32 FOR $59.95

NEW! G.I. COMPUTER SOUND CHIP

AY3-8910. As featured in July, 1979 BYTE! A fantastically powerful Sound & Music Generator. Perfect for use with any 8 Bit Microprocessor. Contains: 3 Tone Channels, Noise Generator, 3 Channels of Amplitude Control. 16 bit Envelope Period Control, 2-8 Bit Parallel I/O. 3 D to A Converters, plus much more! All in one 40 Pin DIP. Super easy interface to the S-100 or other busses. **$11.95** **PRICE CUT!**

SPECIAL OFFER: ~~$14.95~~ each Add $3 for 60 page Data Manual.

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"THE BIG BOARD"

OEM - INDUSTRIAL - BUSINESS - SCIENTIFIC

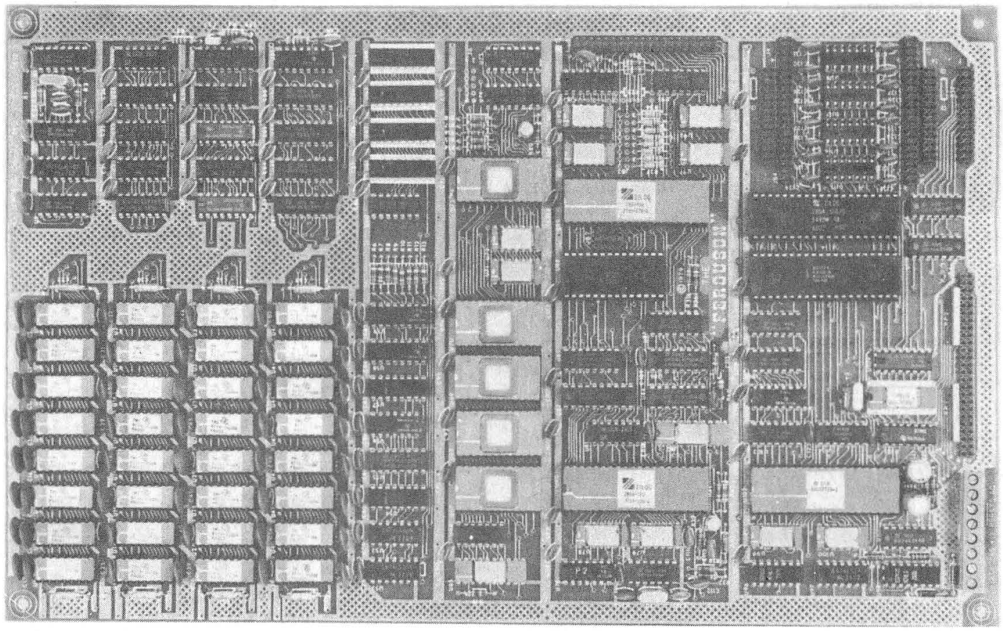
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Z-80 CPU! 64K RAM!

NEW LOWER PRICES

NEW!

PARTIALLY ASSEMBLED KITS
For All Sockets Installed
And Soldered Add $50.



WANT MORE INFO?
Full Documentation and
Schematics — $5.

THE FERGUSON PROJECT: Three years in the works, and maybe too good to be true. A tribute to hard headed, no compromise, high performance, American engineering! The Big Board gives you all the most needed computing features on one board at a very reasonable cost. The Big Board was designed from scratch to run the latest version of CP/M*. Just imagine all the off-the-shelf software that can be run on the Big Board without any modifications needed! Take a Big Board, add a couple of 8 inch disc drives, power supply, an enclosure, C.R.T., and you have a total Business System for about 1/3 the cost you might expect to pay.

$499.00 ** (64K KIT BASIC I/O)

SIZE: 8½ x 13¾ IN.
SAME AS AN 8 IN. DRIVE.
REQUIRES: +5V @ 3 AMPS
+ - 12V @ .5 AMPS.

FULLY SOCKETED!

FEATURES: (Remember, all this on one board!)

64K RAM

Uses industry standard 4116 RAM'S. All 64K is available to the user, our VIDEO and EPROM sections do not make holes in system RAM. Also, very special care was taken in the RAM array PC layout to eliminate potential noise and glitches.

Z-80 CPU

Running at 2.5 MHZ. Handles all 4116 RAM refresh and supports Mode 2 INTERUPTS. Fully buffered and runs 8080 software.

SERIAL I/O (OPTIONAL)

Full 2 channels using the Z80 SIO and the SMC 8116 Baud Rate Generator. FULL RS232! For synchronous or asynchronous communication. In synchronous mode, the clocks can be transmitted or received by a modem. Both channels can be set up for either data-communication or data-terminals. Supports mode 2 Int. Price for all parts and connectors: $65.

BASIC I/O

Consists of a separate parallel port (Z80 PIO) for use with an ASCII encoded keyboard for input. Output would be on the 80 x 24 Video Display.

24 x 80 CHARACTER VIDEO

With a crisp, flicker-free display that looks extremely sharp even on small monitors. Hardware scroll and full cursor control. Composite video or split video and sync. Character set is supplied on a 2716 style ROM, making customized fonts easy. Sync pulses can be any desired length or polarity. Video may be inverted or true. 5 x 7 Matrix - Upper & Lower Case

FLOPPY DISC CONTROLLER

Uses WD1771 controller chip with a TTL Data Separator for enhanced reliability. IBM 3740 compatible. Supports up to four 8 inch disc drives. Directly compatible with standard Shugart drives such as the SA800 or SA801. Drives can be configured for remote AC off-on. Runs CP/M* 2.2.

TWO PORT PARALLEL I/O (OPTIONAL)

Uses Z-80 PIO. Full 16 bits, fully buffered, bi-directional. User selectable hand shake polarity. Set of all parts and connectors for parallel I/O: $19.95

REAL TIME CLOCK (OPTIONAL)

Uses Z-80 CTC. Can be configured as a Counter on Real Time Clock. Set of all parts: $9.95

BLANK PC BOARD — $175

The blank Big Board PC Board comes complete with full documentation (including schematics), the character ROM, the PFM 3.3 MONITOR ROM, and a diskette with the source of our BIOS, BOOT, and PFM 3.3 MONITOR.

CP/M* 2.2 FOR BIG BOARD

The popular CP/M* D.O.S. to run on Big Board is available for $159.00.

PRICE CUT!

PFM 3.3 2K SYSTEM MONITOR

The real power of the Big Board lies in its PFM 3.0 on board monitor. PFM commands include: Dump Memory, Boot CP/M*, Copy, Examine, Fill Memory, Test Memory, Go To, Read and Write I/O Ports, Disc Read (Drive, Track, Sector), and Search. PFM occupies one of the four 2716 EPROM locations provided.

Z-80 is a Trademark of Zilog.

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TERMS: Shipments will be made approximately 3 to 6 weeks after we receive your order, VISA, MC, cash accepted. We will accept COD's (for the Big Board only) with a $75 deposit. Balance UPS COD. Add $4.00 shipping.

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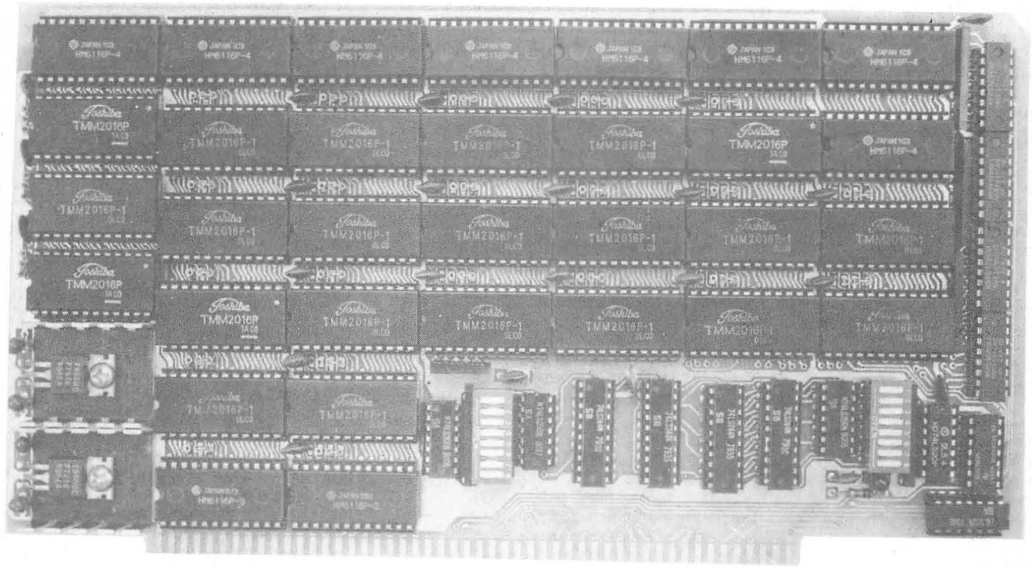
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- ☐ 5. IBM
- ☐ 6. North Star
- ☐ 7. OSI
- ☐ 8. PET/CBM
- ☐ 9. SWTP
- ☐ 10. TRS-80
- ☐ 11. Other
- ☐ 12. Don't type any in

B. My computer use is:
- ☐ 1. Work-related only
- ☐ 2. Not related to my work
- ☐ 3. Both of the above
- ☐ 4. Don't use a computer

C. What is your position at work?
- ☐ 1. Owner
- ☐ 2. Associate
- ☐ 3. Partner
- ☐ 4. Manager
- ☐ 5. Other

D. How much money has your company spent on computer equipment this year?
- ☐ 1. Under $1,000
- ☐ 2. $1,000—$5,000
- ☐ 3. $5,001—$25,000
- ☐ 4. Over $25,000

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- ☐ 1. Computer or electronics store
- ☐ 2. Department store
- ☐ 3. Mail order
- ☐ 4. Direct from manufacturer
- ☐ 5. Office equipment dealer

F. Would you buy a dump of the programs for your system printed in *Microcomputing*?
- ☐ 1. Yes—disk
- ☐ 2. Yes—cassette
- ☐ 3. No

G. What types of programs published in *Microcomputing* do you actually type in? Check up to 4 categories of most interest.
- ☐ 1. Business
- ☐ 2. Games
- ☐ 3. Utilities
- ☐ 4. Education
- ☐ 5. Graphics
- ☐ 6. Hobby
- ☐ 7. Home Finance/Management

H. Do you own a stringy floppy?
- ☐ 1. Yes
- ☐ 2. No, but plan to buy one
- ☐ 3. No, don't plan to buy one

I. In purchasing a system, which one of the following factors is most important to you? Check one only.
- ☐ 1. Price
- ☐ 2. Expandability
- ☐ 3. Service and maintenance
- ☐ 4. Software availability

J. For how long do you keep copies of *Microcomputing*?
- ☐ 1. Less than 1 year
- ☐ 2. 1-2 years
- ☐ 3. Over 2 years
- ☐ 4. Never throw/give away
- ☐ 5. Doesn't apply

K. How much time do you spend reading *Microcomputing*?
- ☐ 1. Less than 1 hour
- ☐ 2. 1-3 hours
- ☐ 3. 3-5 hours
- ☐ 4. More than 5 hours

L. On a scale of 0 (no interest) to 5 (most interest) rate your interest in the following specialized article themes:
- ___ 1. Education
- ___ 2. Hardware design
- ___ 3. Scientific
- ___ 4. Home use
- ___ 5. Graphics
- ___ 6. Games
- ___ 7. System-specific

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- ☐ 1. Computer magazines
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6 POKE570,255:POKE571,202:POKE572,208:POKE573,246:POKE574,104
7 POKE575,96:GOSUB8:GOTO10
8 A = USR(B)
9 RETURN
```

Listing 3. Clear screen routine.

(letters from page 34)

executing print statements to scroll the screen. The routine (Listing 3) is easy to incorporate into your programs, and makes them look more professional when they run.

The routine is a machine-code program converted into POKE statements for use in Basic programs. How it works isn't important, so I'm not going to explain it. It's only necessary to know that to use the routine, execute a GOSUB 8 statement when you want the screen cleared. When your program executes a GOSUB 8 statement it will branch to the function in line 8 (A = USR(B)). The function in line 8 branches to the machine-code program and clears the screen, then returns to the Basic program and continues at the statement following the GOSUB 8.

You can use the routine as a utility of sorts by saving it on tape. Then, before entering a program you're writing, load the routine so it becomes part of your program. The routine can also be inserted into previously written programs if they don't start before line 10.

You can execute this routine in the immediate mode too. This is very handy when you're working on a program and want the screen cleared. Just type in GOSUB 8 and the screen will clear.

Charles Emerson-Henry
Minneapolis, MN

Micro-Courier Defended

Microcom has several serious objections with Mr. Frank Derfler's review of Micro-Courier in the Dial-Up Directory section of January's *Microcomputing* (p.14). These objections fall into three categories—errors, omissions and overall approach.

Most importantly, Mr. Derfler incorrectly states that Micro-Courier requires some quality control check on transmissions. In fact, however, the Micro-Courier protocol ensures reliable and error-free transmission and is considered state-of-the-art within the field of microcomputer communications. The Micro-Courier protocol includes error detection and recovery mechanisms. Error detection mechanisms employ both a character parity check and a block checksum. Micro-Courier will retransmit on detection of error.

Mr. Derfler omits an important Micro-Courier feature—the ability to transmit any Apple DOS 3.3 file *including binary files*. This permits users to transmit charts and graphs by VisiPlot, for example, or other binary programs and files. Again, the Micro-Courier protocol ensures reliable and error-free communication.

Gregor N. Ferguson
Software Product Manager
Microcom, Inc.
Norwood, MA

According to Frank Derfler, Jr. (January 1981, Dial-Up Directory, p. 14), Microcom's software package, Micro-Courier, is lacking in many standard error checking routines to insure 100 percent correct transmission. Our experience in using this package in a work environment has not proven this true. In the nine months we have been using this package, we have had no problems in this area. We have found the package easy to use.

We recommend it as a software package which fits into a business environment.

Ronald E. Burr
Catalog Controller's Dept.
J.C. Penny Company, Inc.
Milwaukee, WI

The ZX81 Kit

After 61 issues I have finally gotten my feet wet with a Sinclair ZX81 kit. I have successfully completed my kit but not without some problems. Those who are considering building kits might appreciate some help.

I purchased my kit in late November and it arrived mid-December. All the parts were there except the transfer switch. I assembled it in about four hours during which time I had to remove the resistor networks RP1 and RP3 that I had installed backwards. When I applied power nothing happened. My unit came with some extra components that turned out to be part of the input power rf filter (I1, I2 and C13) which do not show up on the parts list or the schematic. After installing I1, I2 and C13 (they were marked on the PC board, near the regulator) the TV screen was synching but the picture was oddly patterned. I traced through the circuit using the schematic and found that R3 had a 2.2k resistor and R6 had none on the PC board. I had used the parts list to assemble the parts and it incorrectly calls out R3 and R6. R6 should be 2.2k and R3 is not used. I also found that R15 was listed as 1k in the parts list but should be 220k as shown on the schematic (it is part of the Z-80A chip's power-on-reset).

Once I corrected these omissions and errors the system ran properly. My only problem now is that the power plug easily unplugs from the unit causing the loss of the program. I will eventually provide either a battery backup (0.5 to 1 amp at 9 V dc) or hardwire the input plug and install an on/off switch in the line.

I have had limited use so far but the 8K Basic is easy to use and the single stroke commands are easy to adapt to. I expect I'll shell out another $100 for the 16K memory as soon as I generate programs that exceed the 1K RAM that comes with the ZX81.

David L. Rogers
Goleta, CA

Please see our review of the ZX81 on page 80.—Eds.

Expand Your Horizon

I want to express my appreciation to the readers who wrote concerning my article, "Expand Your Horizon" (*Microcomputing*, Jan. 1982, p. 118). I also want to thank Brad Kohn of Irvington High School and John Smith of the Computer Shoppe for their thoughtful suggestions.

Some issues were raised which require further clarification. To use the provided programs your system must have at least 24K RAM starting at address zero, be running DOS 5.2DQ with origin 100 hexadecimal and execute Z-80 code. Consequently, prospective users with single-density systems or those using an 8080 CPU must modify the machine-language subroutines.

I also want to mention an inexpensive third solution to the connection problem. A NSCOM user could dedicate the second serial port to communication by rewiring the configuration header as described in North Star's manual, "HRZ-D" p. 72.

An enhanced version of NSCOM is available from the Computer Shoppe. If interested check their advertisement.

Patrick Corry
Shirley, NY

Medical and Dental Software

In your Nov. editorial (Editor's Notes, p. 6) you say: "There seems to be little commercially available microcomputer software to aid the health-care professional in this area." Not quite true. We have been specializing in medical and dental software for a number of years on larger machines. In 1979 we turned our attention to microcomputers and wrote

MEDIC80 to run under the CP/M and MP/M operating systems. This package brought our considerable experience to the microcomputer user. MEDIC80A and DENTAL80A are now being installed. Both packages contain additional enhancements suggested by the doctors and dentists using the software.

Both packages contain medical note files to help the doctor or dentist keep a medical treatment record. During the last year we have also gotten into nutritional analysis by working with some of the country's leading authorities in this field. A nutrition package will be available as an option later this year.

Our software is sold to the end-user through distributors and dealers in many major (and some minor) cities in the United States and Canada. Recently we merged with our California distributor so our products are now being marketed under the MEDCOM name.

Ron Tipton
The Systems Shoppe
PO Box 227
Greenwood, MO 64034

Flexible, Portable MUMPS

I was most pleased to see an article on MUMPS in your February issue ("Is MUMPS the Cure?" Richard Walters, p.54). MUMPS has been overlooked in this country although it is used much more extensively in Europe and Japan. It is probably the best choice for an interactive business type program requiring flexible databases.

Because its database and I/O structures are included in its ANSI standard specifications, MUMPS is truly portable. Standard MUMPS is run on hardware as diverse as DEC (PDP-11 and VAX), TANDAM, AMDAHL (under UNIX), and Data General (NOVAS and ECLIPSES) as well as the micros mentioned in Walter's article.

COMP Consultants is a provider of both single and multiuser MUMPS systems utilizing a Motorola 6809 CPU on hardware including TANO Outpost-11, GIMIX, Commodore SuperPet, Hazelwood and Southwest Technical Products.

Your February issue incorrectly listed our address. It should be COMP Consultants, Inc., 6910 Fannin, Suite 307N, Houston, TX 77030. 713-790-0497.

David B. Brown, President
COMP Consultants, Inc.
Houston, TX

Osborne Revisited

As a serious user of the new Osborne computer, I invite other owners to join in forming a user's group for mutually beneficial information exchange. I am located in northern San Diego county near the Orange county border and would be happy to hear from Osborne owners in this part of the country.

My personal interests are heavily into security analysis, both technical and fundamental, and I am finding the SuperCalc spreadsheet to be of major assistance in my work. I would be happy to exchange information on this subject with other investors regardless of their location.

My Osborne has proven to be convenient, productive and trouble-free. My one complaint to date (and I understand that it is a general problem in the industry) is the quality and quantity of the manufacturer-supplied documentation. An active organization of Osborne users should help to fill this deficiency.

As an initial contribution to forming one or more user's groups I will undertake to send a progress report to everyone who sends me a stamped, addressed envelope. Let's hear from you out there.

R.B. Gordon
276-167 N. El Camino Real
Oceanside, CA 92054

I noted with interest the letter from Mr. Moyer on Osborne (Letters to the Editor, Nov. 1981, p.211). I recently purchased an Osborne 1 and I must say I had quite the

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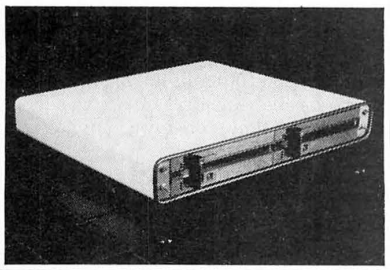
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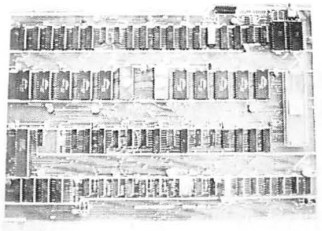
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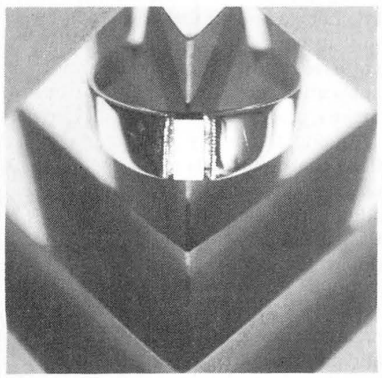
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reverse treatment. I purchased the unit through a Xerox store and received nothing but the best of assistance, information, etc. The price was exactly as stated at $1795 plus tax for the unit plus all advertised software/manuals. Then, upon sending the end user agreements to Osborne's main offices, I quickly received additional information plus notes on bugs, future offerings in the way of upgrading, i.e., dual-density drives, modem, improved keyboard, etc., with the promise of a future listing of approved software. All in all I am not only very pleased with the unit but with the association with Osborne and my particular dealer. So Mr. Moyer, it would appear that you were unfortunate in your selection of dealers and you have my sympathy. Please don't give up on Osborne!

E.A. Flynn
Mesquite, TX

Oops!

While reading "Sorting Techniques Explained" by H.S. Gentry (Nov. 1981, p.156) I encountered an obvious error in the paragraph just before the conclusion (p.160): "This change makes the algorithm about 8 percent faster with 500 elements to be sorted and almost 14 percent faster with 500 elements."

I'm not sure what numbers should be there, but if you are comparing execution time for X and Y number of elements, may I suggest that either one of those 500s should be a smaller number or else something is missing such as a greater than or less than statement.

J.P. Yerger
Hyde Park, MA

You're right—you've spotted the editor's nemesis, the typographical error. The sentence should read "This change makes the algorithm about 8 percent faster with 200 elements to be sorted and almost 14 percent faster with 500 elements." Thank you for your attentive reading. We apologize for any confusion this may have caused.—Eds.

IBM PC Hardware And Software

I am in the process of developing a database of software and hardware for the IBM Personal Computer. I plan to publish two monthly listings: one will list the new additions and the other will list all the software and hardware available to that date. The listings could be obtained at nominal charges from the address given below. At this moment I have about 55 items in my list and hope it would grow soon.

The listings would have two parts—one part will cover the hardware available for the system and the second part will cover the software available in all the areas. The list will be indexed by the title and source. Classification of the product, name of the product, product description, configuration required, available form, price, source and other necessary information will be included in the listings.

Interested parties developing hardware or software should write as soon as possible to include their product in the list. Persons looking for available hardware and software should also write for more information to: Sapana Micro Software, PO Box 748, Quincy, IL 62301.

Kailash Chandra
Quincy, IL

Build Your Own Micro

An article "Build Your Own Micro" was printed in the September 1980 issue of *Microcomputing* (p. 62).

Is there anyone who has built it and implemented an RS-232 device on it? The outfit I bought the micro from could not help me or give me the listings of the monitor.

Tom Milutin
Newton, MA

Don't Give Up!

I have just finished reading your editorials in the November 1981 issue of your publication and decided I must respond. The subject that has prompted me to write is the content matter in *Microcomputing*.

First of all I should explain who I am. I am a businessman in the airline industry, in upper-level management and do not have access to a business computer. I am in my upper fifties with only three years of college. I obtained my first computer in June 1978 (a TRS-80 Model I) and upgraded to a TRS-80 Model III in December 1980. I use my computer strictly at home for personal education and enjoyment. My principal interests are home and household applications, personal finances and miscellaneous other useful applications. I do not spend time on games. I generally only have time for my computer on weekends.

Gaining the knowledge of how to use my computer efficiently is one of my biggest problems. Finding time to study the many confusing textbooks is a further problem, and I find that most textbooks are extremely confusing and generally do not tell me the basic things I need to know. I do not care about the knowledge necessary to write long and complicated programs. I need to know more about basic application, error correcting and how to make a program do what I want it to do.

Among the many computer publications that I subscribe to I generally look only for those article and programs that address themselves to the TRS-80 and the Basic language. Generally speaking, your publication along with *Creative Computing*, *Popular Computing*, *Byte*, and *Personal Computing* are not specific enough for me and cover too many articles and programs on equipment that I cannot use. I am not at all interested in Apple, PET or IBM.

I would like to see more tutorials aimed at the beginner, like me. Why hasn't someone written articles, or a book, on converting one Basic dialect to another? I have seen many excellent programs developed for other computers but do not know how to modify them for my TRS-80. Perhaps authors should be encouraged to give the necessary modifications along with their programs.

The sum and substance of this letter is if you stray away from TRS-80 programs, articles and applications, dumbbells like me will lose interest in your otherwise fine magazine.

Eric Norton
Oklahoma City, OK

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You seem like a prime candidate for two of our sister publications—Desktop Computing *(the plain language computer magazine for the businessman)* and 80 Microcomputing *(the magazine for TRS-80 users). We are sending you subscription information and sample copies of these magazines.—Eds.*

CP/M Version of Touch Typist

I would like to thank *Microcomputing* for publishing J.C. Hassall's well-written review of Touch Typist (Jan. 1982, p. 203). Mr. Hassall reviewed the Heath HDOS version of the program. An identical CP/M 2.0 version is also available. Each program sells for $29.95 and can be purchased direct from Newline Software or from any Heathkit Electronic Center. The HDOS version requires the H8/H19 or H/Z89 computer. The CP/M version requires the H8/H19 or H/Z89 or 8080/Z80 with the H19 terminal. Both versions require 24K of memory. Heathkit computer owners are invited to send requests for information on other software products to Newline Software.

Ron Rocheleau
Newline Software
PO Box 402
Littleton, MA 01460

HELP!

I'm having a problem with my computer system that others may be experiencing too.

I have an Apple II Plus and an Epson MX-100 printer with a Tymac parallel interface card. The problem is with the flash command. An example will show the problem better. Run the following program to generate the full character set to the MX-100:

```
10 for I = 32 to 127
20 Print CHR$ (I);
30 Next I
```

No problem! Now change the program to read:

```
10 for I =32 to 127
20 Flash: Print CHR$ (I);
30 Next I
40 Normal
```

What happens is that most symbols and all numbers print out in lowercase letters.

When I had an MX-80F/T (without Graftrax), there was no problem. There is also no problem with the inverse command.

But, keeping all things constant (the Apple II Plus, the Tymac card and the printer), the only change from the MX-80 to the MX-100 is the addition of the Epson Graftrax PROMs.

Epson says it's the Apple; Apple says it's the Epson PROM; everyone says it's not the Tymac card.

HELP! Does anyone have an answer?

S. Richard Ravich
Vice President Marketing
AKG Acoustics, Inc.
77 Selleck St.
Stamford, CT 06902

Your Basic Identity Crisis

According to the dictionary, the word "basic"—whether used as a noun or as an adjective—refers to something fundamental.

To the computer breed, BASIC has a specific meaning; it refers to a language, admittedly with many dialects, but still a language.

Your decision (As the Word Turns, March 1982, p.176) to demote BASIC to Basic can lead to a frustrating lack of understanding on the part of your readers. There will often be the need to stop and consider whether the standard English word or the name of a computer language is meant.

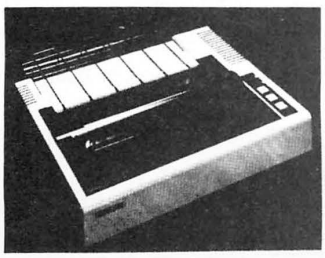
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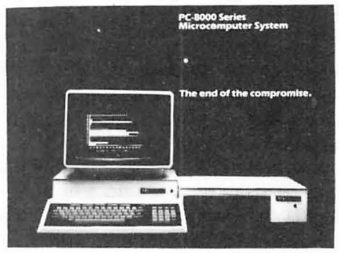


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Edited by Linda Stephenson

Experiment with ISAAC/Apple Mods Sixteen Bits Speed Up the Action Made for Ada



The Micro-Professor from Etronix.

Electronic Teaching Tool

The Micro-Professor is a Z-80-based microprocessor learning system designed for personal use. The unit comes with a six-digit LED display, 2K bytes of ROM (expandable to 8K), 2K bytes of RAM, 24 I/O lines, 2K bytes of monitor, audio cassette interface, counter timer circuits, user wire-wrap area, 36-key keyboard, 9 V power adapter and extension connectors to provide all expansion signals. The system is expandable with Z-80-CTC, Z-80-P10 and an EPROM board programmer. The price is $129.95.

Etronix, 14803 N.E. 40th, Redmond, WA 98052. Reader Service number 464.

Expanded System

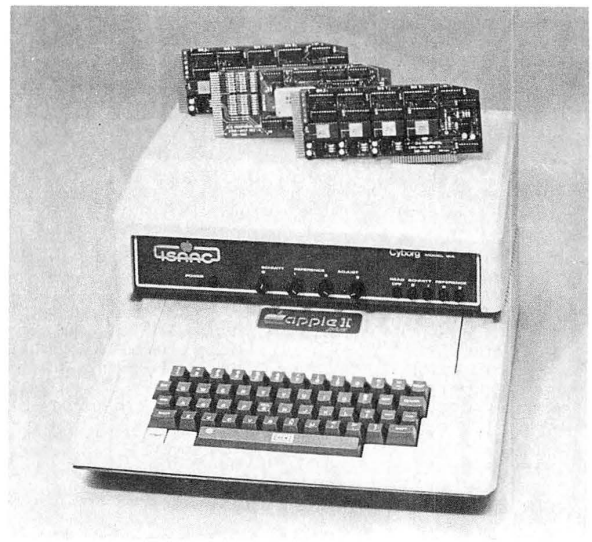
The Cyborg Corp., 55 Chapel St., Newton, MA 02158, has announced three plug-in expansion modules for additional input-output channels on its Apple-based data acquisition and control system. The ISAAC/Apple system was introduced last fall in a standard configuration that included 16 analog inputs, four analog outputs, 16 binary inputs and 16 binary outputs—plus timer, counter, real-time clock, four Schmitt triggers and LabSoft. The new expansion modules allow significant channel expansion for process control, electronic test and energy management.

The ADC expansion module, priced at $850, offers 16 additional analog input channels, with 12-bit analog to digital conversion. The D/A module offers four analog output channels for $725; it consists of four discrete digital to analog converters. The binary module allows 16 binary inputs and 16 binary outputs. It operates with a latching 16-bit I/O data bus with full handshaking; price is $325. Reader Service number 469.

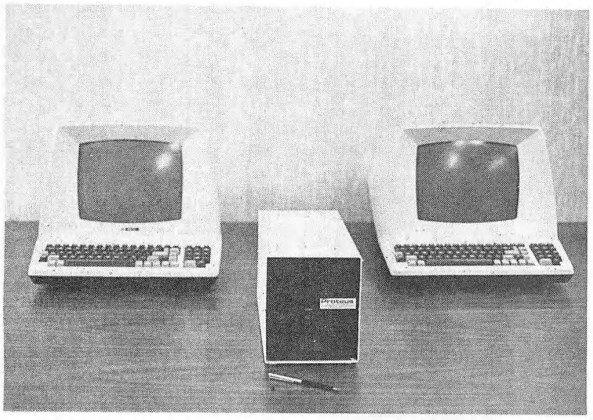
Sixteen Bits

Innovative Electronics Technology Ltd., 6993 A Antrim Ave., Burnaby, B.C. V5J 4M5, Canada, offers its 16-bit Z8001 single-board microcomputer, Proteus. This modular system is easily upgraded to a full multi-user system capable of handling up to 510 users with true distributed processing and no degradation in individual performance. The CPU board contains a 4 MHz Z8001, two serial ports and a real-time clock. The board also contains 128K bytes of dynamic RAM for user memory, 8K of static RAM for system memory, and 16K of ROM containing the two-user BITOS operating system. Benchmarks written in Microsoft Basic run up to ten times faster than identical programs running on a 4 MHz Z-80. All I/O is interrupt-driven, and a 9511/12 floating point processor is optional. Proteus was designed to mount on the side of a 5¼-inch Winchester hard disk; this allows up to 256 Proteus modules to be linked through a BIBUS controller card. The basic Proteus unit, which includes a 5¼-inch floppy drive, is priced at $4860, U.S. Reader Service number 467.

Delphi-100, a dual-proces-



Three new expansion modules for the ISAAC/Apple system are available from Cyborg.



I.E. Technology's Proteus microcomputer, shown here with terminals for a simple two-user configuration.

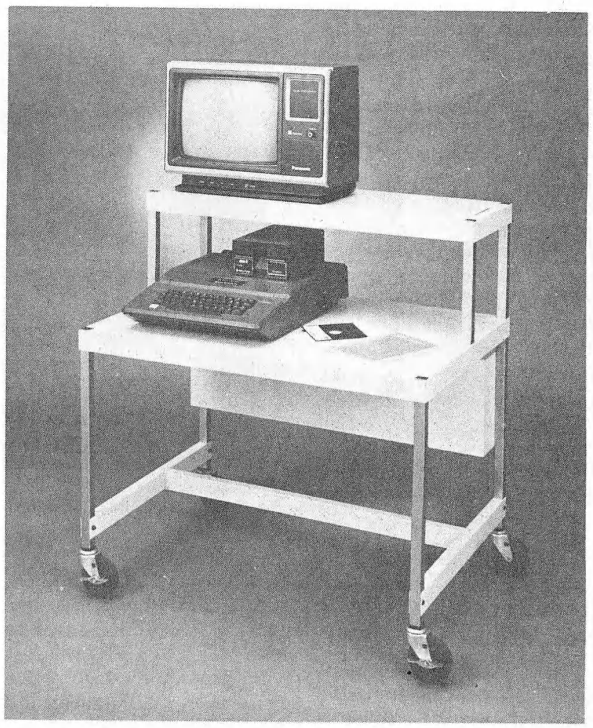
sor S-100 system, is based on the 16-bit MC68000 CPU and eight-bit Z-80 CPU, with software-controlled switching between them. This arrangement gives Delphi-100 the software and hardware advantages of the new generation of CPUs, while retaining compatibility with old peripherals and programs. Delphi-100 is tailored to run Ada, the language developed by the U.S. Defense Department. Delphi-100 also supports a multitasking Pascal and all 8080 and Z-80 software, including CP/M. Multitasking languages Ada and Pascal are available on Delphi-100 with the TeleSoft ROS-Ada operating system. The TeleSoft Ada compiler approaches a complete implementation of Ada; it checks syntax for the entire Ada language and generates code for all but the most complex features.

Digicomp Research Corp., Terrace Hill, Ithaca, NY 14850. Reader Service number 466.

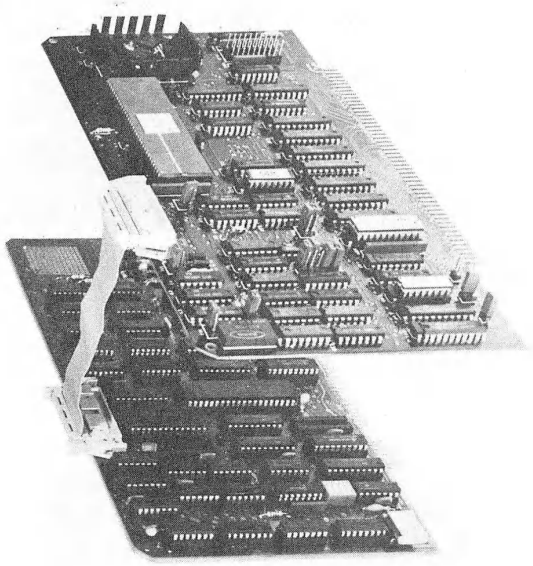
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The EC10 microcomputer table was designed specifically for school and training purposes. The unit offers clean styling, easy adjustability and safe mobility. It features an adjustable top shelf and work surface, a slotted top shelf for safely securing a monitor or other equipment in place, a cord organizer/modesty panel for keeping loose cords and connectors off the floor and out of the way, and an ES unit comprising three outlets, a 20-foot, three-wire cord and grounded plug. The EC10 is made of heavy gauge steel, and has four-inch casters (two with locking brakes) and six square feet of work surface. Standard 27-inch typing-height work surface can be lowered for children.

Bretford Manufacturing, 9715 Soreng Ave., Schiller Park, IL 60176. Reader Service number 465.



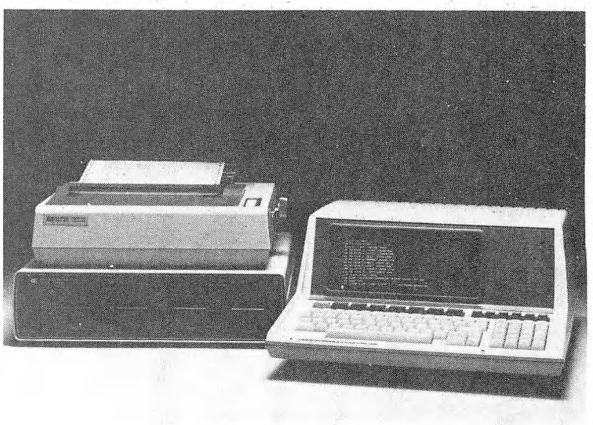
The EC10 microcomputer table from Bretford Manufacturing.



Digicomp Research Corp. has introduced the Delphi-100 dual-processor system.

Expandable HP System

A new microcomputer from Hewlett-Packard features an



The HP-87 from Hewlett-Packard is supported by a full range of peripherals, including the HP 82901M dual disk drive and HP 82905B printer.

integrated high-resolution, 80-column, text-and-graphics display, enhanced HP Basic programming language and expanded software support. The HP-87's 32K-byte memory can be expanded to 544K. A plug-in CP/M system is available. All of Hewlett-Packard's personal computer peripherals are compatible with the HP-87, including the new 7470 graphics plotter. The HP-87 is available from local Hewlett-Packard sales offices for $2495.

Inquiries Manager, Hewlett-Packard Company, 1820 Embarcadero Road, Palo Alto, CA 94303. Reader Service number 482.



Northwest Instrument Systems' Model 85 oscilloscope module.

Two-Port Serial I/O Card

The Dual-Comm Plus adds two fully independent serial I/O interfaces to an Apple II. It combines the features of the Apple high-speed serial card and Apple communications card in one plug-in card with handshaking. Thumbwheel switches select the Apple slot locations. Sixteen switch-selectable data rates for each port range from 50 to 19,200 bits per second. On-board firmware provides extensive printer and upper/lowercase terminal/modem support. Dual-Comm Plus works with the standard Apple 40-column display or with an 80-column card. It can be programmed for asynchronous, synchronous or SDLC operation. The card supports interrupts. The design is based on the Z-80 SIO chip. Price is $239.

Bit 3 Computer Corp., 8120 Penn Ave. S., Minneapolis, MN 55431. Reader Service number 481.

Apple-Compatible Instrument

A dual-channel, DC to 50 MHz digital memory oscilloscope module is available from Northwest Instrument Systems, Inc., PO Box 1309, Beaverton, OR 97075. Their Model 85 uses the display and keyboard as an oscilloscope screen and control panel, the Apple computer for waveform processing, and disk memory for waveform storage. It performs standard laboratory functions such as signal averaging and DVM readout; 8K of Apple memory is available for user program development. Users can program the oscilloscope in Basic or machine language for functions such as Fast Fourier Transform, auto- and cross-correlation, power density spectra, and integration and differentiation. Using a fast sampling technique, the Model 85 acquires data through probes or cables connected to the module at the back of the computer. Fastest sweep speed is 10 ns/div, and, at 1 ms/div and slower, the scope operates as a real-time A/D conversion system. Price is $995. Reader Service number 480.

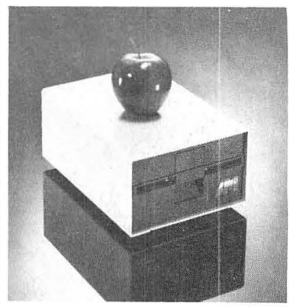
Four Cards on One

Versacard includes a serial I/O interface, parallel output interface, clock/calendar and BSR control on one card. The unique circuit design lets the Apple II "think" that separate cards are installed, making the interface ports compatible with Apple Pascal, Microsoft and most other Apple software. The serial input/output port is RS-232C standard. A terminal mode permits simultaneous output to printer and display. The one-second resolution clock/calendar is compatible with Thunderclock. BSR control requires the addition of an ultrasonic transducer for use with the X-10 Home Control System. On-board firmware provides optional auto line feed, video, paging, lower- to uppercase, and eighth-bit set on clear. Price is $249.

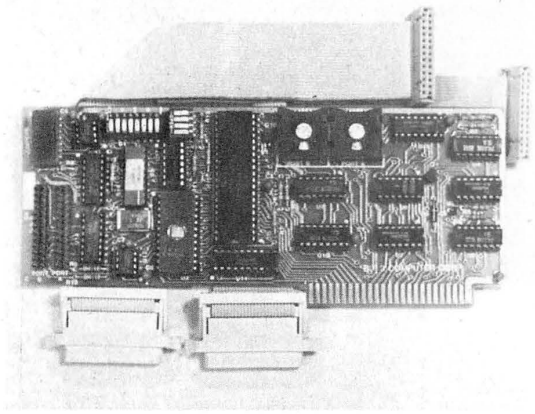
Prometheus Products, Inc., 45277 Fremont Blvd., Fremont, CA 94538. Reader Service number 479.

Disk Storage for Apples

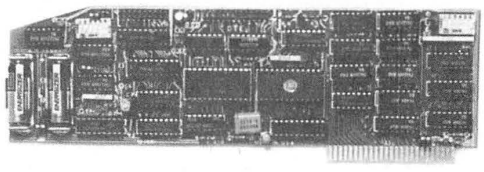
A.M. Electronics, Inc., 3446 Washtenaw Ave., Ann Arbor, MI 48104, has announced its 5¼-inch disk drive for Apple computer systems. Its beige case matches the Apple's. The 40-track drive is $395; an 80-track version is priced at $495. Reader Service number 478.



A.M. Electronics' Apple-compatible disk drive.



Dual-Comm Plus I/O from Bit 3.



The Versacard from Prometheus Products, Inc.



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Chart shows total capacity in Bytes for 2 drives.

Contact GIMIX for price and availability of 8" floppy disk drives and cabinets; and 5" and 8" Winchester hard disk system.

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NOTE: *UNIFLEX can not be used with 5" minifloppy drives.*

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GIMIX Systems are found on every continent, except Antarctica. (Any users there? If so, please contact GIMIX so we can change this.) A representative group of GIMIX users includes: **Government Research and Scientific Organizations** in Australia, Canada, U.K., and in the U.S.; NASA, Oak Ridge, White Plains, Fermilab, Argonne, Scripps, Sloan Kettering, Los Alamos National Labs, AURA. **Universities:** Carleton, Waterloo, Royal Military College, in Canada; Trier in Germany; and in the U.S.; Stanford, SUNY, Harvard, UCSD, Mississippi, Georgia Tech. **Industrial users** in Hong Kong, Malaysia, South Africa, Germany, Sweden, and in the U.S.; GTE, Becton Dickinson, American Hoechst, Monsanto, Allied, Honeywell, Perkin Elmer, Johnson Controls, Associated Press, Aydin, Newkirk Electric, Revere Sugar, HI-G/AMS Controls, Chevron. **Computer mainframe and peripheral manufacturers,** IBM, OKI, Computer Peripherals Inc., Qume, Floating Point Systems. **Software houses;** Microware, T.S.C., Lucidata, Norpak, Talbot, Stylo Systems, AAA, HHH, Frank Hogg Labs, Epstein Associates, Softwest, Dynasoft, Research Resources U.K., Microworks, Analog Systems, Computerized Business Systems.

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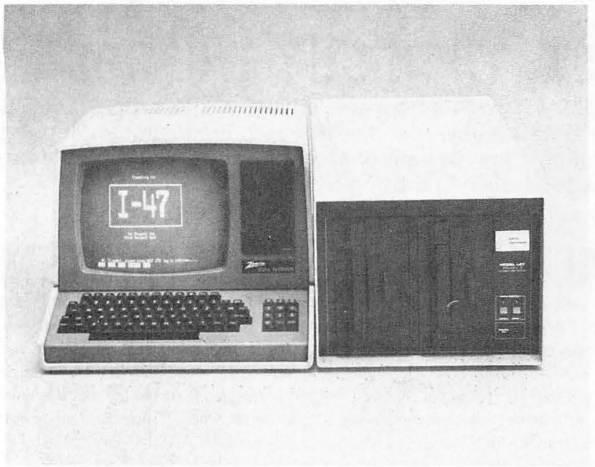
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Data Compass offers the I-47 disk drive system for Heath/Zenith microcomputers.



Franklin Computer Corp. Ace 100.

Intelligent Disk System for Heath/Zenith

An eight-inch floppy disk drive system for use with Heath/Zenith microcomputers is available from Peripheral Products Group, Data Compass, 2730 Regal Park Drive, Anaheim, CA 92806. The I-47 intelligent system reduces the need for host computer intervention, does automatic density sensing and switching, and provides automatic copying and formatting. The system consists of two double-density, double-sided drives with a formatted capacity of 1.25 megabytes per drive. The drives, which are in a master/slave relationship, are built into a compact cabinet with write-protect switches and indicators, power-on LED, and built-in power supply, fan, data cable and complete documentation. Up to three slave drives can be daisychained to the master for a storage capacity of more than 5M. A 6800 microprocessor on the master drive handles control and formatting functions. Price is $2795. Reader Service number 475.

A Low-Cost 1200-bps Modem

Universal Data Systems, 5000 Bradford Drive, Huntsville, AL 35805, has added the Model 212 LP to its modem line. Powered from the telephone line, this manual-answer unit requires no external ac power, and offers full-duplex 1200-bit-per-second asynchronous operation. Its low profile housing is designed for desk-top use. Price is $495. Reader Service number 476.

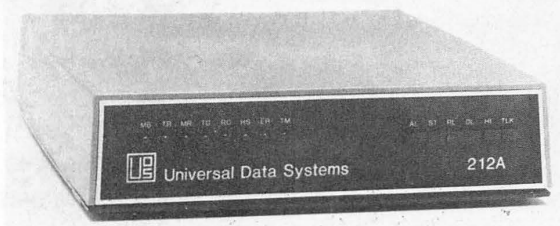
Apple II Work-Alike

The Franklin Ace 100 is a 64K-byte microcomputer that is hardware and software compatible with the Apple II. It has a full upper- and lower-case keyboard and character generator. The keyboard includes a 12-key numeric pad, an alpha shift lock key and special keys with VisiCalc designations. The basic unit costs $1595.

Franklin Computer Corp., 7030 Colonial Highway, Pennsauken, NJ 08109. Reader Service number 477.

Drive Saver

Optronics Technology, 2990 Altantic Ave., Penfield, NY 14526, is offering a new product for eight-inch floppy disk users that provides automatic on/off control for the drive motor. This eliminates noise from the drive unit and significantly reduces wear. The Drive Control Unit (D.C.U.) is designed for easy installation. Connectors allow it to fit within the drive assembly in series with the drive motor. During drive access, the motor is energized at zero-crossing for low noise and will turn itself off after eight seconds of idle time. D.C.U. is





Universal Data Systems' Model 212 LP modem.

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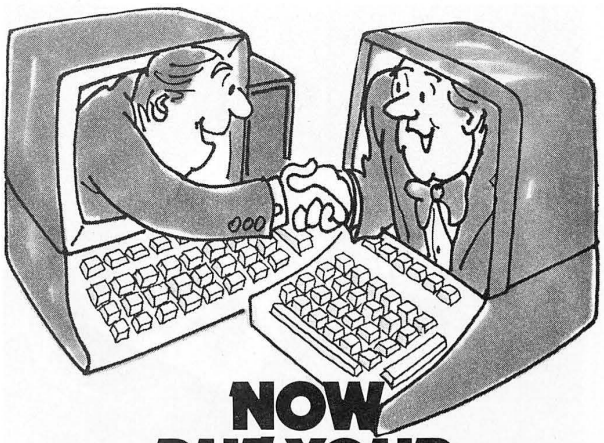
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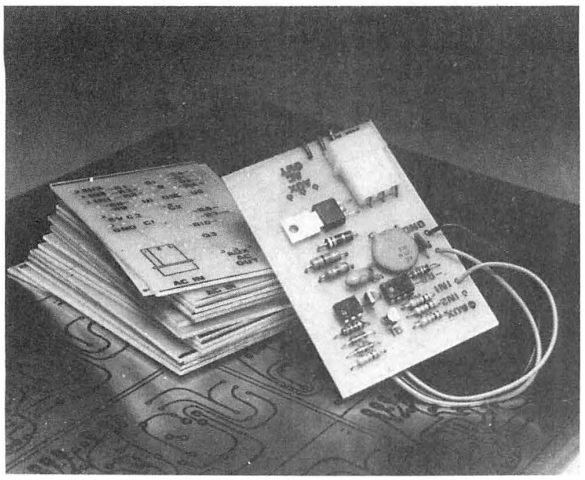
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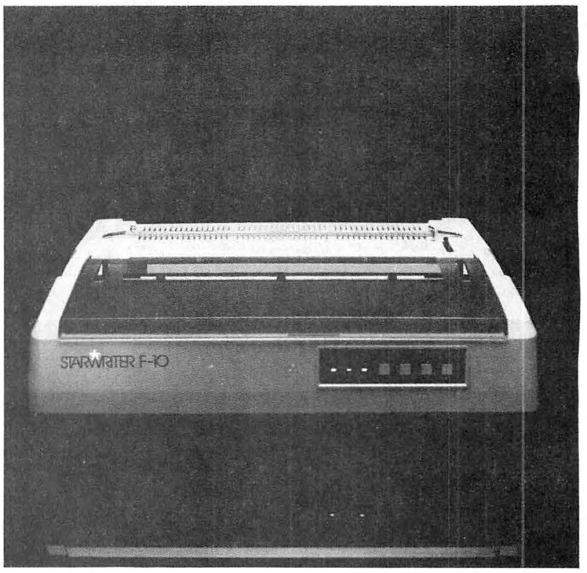
available in kit form for $18.95 or assembled for $29.95. Reader Service number 474.

Switching Device

Advanced Systems Concepts, Inc., PO Box Q, Altadena, CA 91001, announces an instrument that decreases the need for duplicate serial ports or peripheral devices. The ASCI Switch either allows software controllable switching between any two peripherals using only one computer port, or allows two computers to share the same peripheral by software switching of the peripheral between them. Input and output ports of the ASCI Switch are controlled by selecting one of 128 ASCII codes. The control code and data rate are chosen via switches located on the rear of the unit. There is no need for extra cabling or computer cards. The switch can be controlled by either data terminal equipment (DTE) or data communications equipment (DCE) without the need for a null modem. The ASCI Switch can be powered by battery or ac adapter. Model A10 switches ten lines and costs $195; Model A25 switches 24 lines and costs $239. Reader Service number 473.

Versatile Printer Design

The Starwriter F-10 daisywheel printers include such features as low profile design, industry-standard ribbon cartridges, standard parallel or RS-232C interface protocols and extensive built-in word processing functions. You can choose friction feed or optional bidirectional tractor feed, in 40- or 55-cps models; prices vary.



Starwriter F-10 printer from Leading Edge.

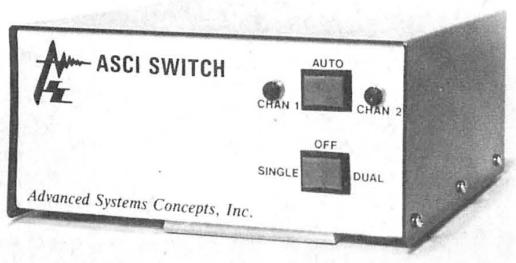
Leading Edge products, 225 Turnpike St., Canton, MA 02021. Reader Service number 472.

Double-Density For Atari

Percom Data Company, 11220 Pagemill Road, Dallas, TX 75243, is now producing disk systems for Atari 400 and 800 computers. The Percom system, which is fully compatible with Atari computers, provides double-density storage, and is available with 40-or 80-track drives. A Percom RFD first-drive system includes disk controller, disk-operating software, interconnecting cable, owner's manual and 5¼-inch disk drive. The provided software adds subroutines to the Atari DOS for handling the higher storage capacity. The system can also be operated with the unmodified, single-density Atari DOS. The RFD controller handles up to four single- or dual-headed drives. Complete RFD systems start at $799. Reader Service number 471.

What's New, Big Blue?

Industry efforts to support the IBM Personal Computer are gaining momentum. Each month Microcomputing *will take a look at some of the*



Advanced Systems Concepts' ASCI Switch.



Percom RFD disk drive systems for Atari microcomputers.

new products being developed for this system. If you have information of interest to our readers, please send it along to: Microcomputing *Editorial, 80 Pine St., Peterborough, NH 03458.*

* * *

The Xedex Corp., 645 Madison Ave., New York, NY 10022, has produced a combination hardware/software device that expands programmable memory and lets the user run CP/M-80 software on his IBM PC. Xedex sells the Baby Blue CPU Plus for $600.

A software solution to the problem of sparse application programs is available from CompuView, 1955 Pauline Blvd., Ann Arbor, MI 48103. CP/M-86 for the IBM PC has the features needed to run the full range of CP/M-86 packages. The VEDIT full-screen editor, intended for program development and simple word processing, is available from CompuView at a discounted price when purchased with CP/M-86.

A text processor that runs with IBM's standard operating system can be purchased from TexaSoft, 1028 N. Madison Ave., Dallas, TX 75208, for $149. Versatext supports Epson and IBM printer features such as wide or compressed printing and special characters.

Laboratory Microsystems, 4147 Beethoven St., Los Angeles, CA 90066, offers complete Forth program development for the IBM PC. The basic package, priced at $100, includes an interpreter/compiler, FIG-Forth line editor, full-screen editor and various utilities. The Floating-point extensions package costs an additional $100, and a Nautilus Forth cross-compiler is an extra $300.

A communications program lets PC users interact with remote time-sharing services or local computers to transfer data files and programs. ASCOM, from Westico, Inc., 25 Van Zant St., Norwalk, CT 06855, is fully compatible with and can communicate with ASCOM running on any CP/M computer. The price is $175.

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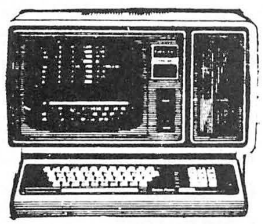
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Edited by Linda Stephenson

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Adventure International, PO Box 3435, Longwood, FL 32750. Reader Service number 498.

Audio Spectrum Analysis

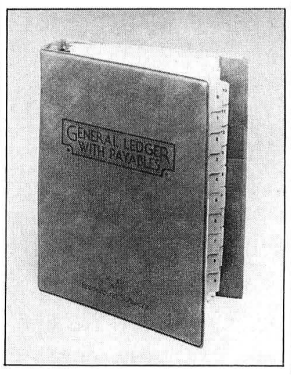
Eventide Clockworks, Inc., 265 West 54th St., New York, NY 10019, now offers software enhancement for the Apple II version of its real-time analyzer. Specsystem, when used with the analyzer and Apple, provides a full range of audio spectrum analysis functions: Reverberation Time (RT-60) displays all 31 ISO-standard ⅓ octave frequencies and the screen can display up to eight frequency plots simultaneously; 3-dimensional spectral surface mode simultaneously displays frequency vs amplitude vs time on the Apple hi-res screen; and a high-resolution real-time analysis display yields greater resolution and more dynamic range options than previously available. The Eventide system (analyzer and Specsystem software) costs $744. Software alone costs $199. A demo program that displays the spectrum analysis of a simulated audio signal will be sent, free, to interested Apple users who mail Eventide a blank 5¼-inch disk. The demo disk simulates the effect of Eventide's hardware/software team for Apple users who haven't yet acquired an analyzer. Reader Service number 483.

Business Accounting

Broderbund Software, Inc., Business Software Division, 1938 Fourth St., San Rafael, CA 94901, offers General Ledger with Payables. This program handles all normal journal ledger and payable functions, plus some management accounting functions. Its capacity is 2000 ledger accounts, unlimited journal entries, 200 open payable accounts, 1900 open invoices, values up to $9,999,999,999.99, 1000 checks per disk and user-definable account numbers up to ten digits. It prints checks and registers, journal audit trails, balance sheets, detailed income statements, department reports and other documents. The program requires a 64K Apple II/II+ with 16-sector disk controller or an Apple III and two disk drives and a printer. Price is $495. Reader Service number 484.

UNIX Features For CP/M

MicroShell runs on any 8080/8085/Z-80 CP/M 2.2 system to bring the power of the UNIX operating system to all CP/M users and software developers. The program manages the interface between CP/M and the user to provide many of the best features of UNIX. Compatibility with CP/M programs is retained but the user can type multiple commands on a line, send normal output to a file instead of the screen and take input from a file instead of the keyboard. MicroShell performs automatic disk drive searches for the program to execute, eliminating the need for disk drive prefixes to filenames.



Broderbund's General Ledger with Payables package includes clearly referenced documentation.

Other features are provided. MicroShell is available on five- or eight-inch disks for $150.

New Generation Systems, Inc., 2153 Golf Course Drive, Reston, VA 22091. Reader Service number 485.

Private Practice

Dental Medical Office Data is a comprehensive database system for physicians and dentists. It comprises 13 programs in which office and personal information can be entered, deleted, changed, sorted, searched and printed in multiple formats. It readily organizes appointments, inventory and employee records. A patient file, phone lists and employee records are maintained, and a dead beat file provides a listing of your most unpopular patients for collection, suits, and no further appointments. The package runs on Apple II+ with disk drive and costs $150.

Andent, Inc., 1000 North Ave., Waukegan, IL 60085. Reader Service number 486.

Utilities for Commodore Computers

Two new programs for the PET and VIC are available from Human Engineered Software, 3748 Inglewood Blvd., Room 11, Los Angeles, CA 90066. HESCOM is a machine-language program that transfers data and programs between two PETs, two VICs or a PET and a VIC. You can

load a program from a disk into the PET/CBM and transfer it to the VIC at 7000 bytes per second—three times the speed of the disk. After modifying the program on the VIC, you could send it back to the PET for saving to a disk or listing on a printer. Price is $49.95 on tape, $52.95 on disk, plus $2 for postage.

HESCAT is a fast, complete cataloging system for a PET/CBM, comprising five programs in Basic and machine language. You can catalog and uncatalog disks and print different reports. Use HESCAT to organize your disk library. Using a full or partial name, in a few seconds you can find which disk a certain program is on. Sorting is done in machine language. Price is $39.95 for HESCAT on disk, plus $2 postage. Reader Service number 487.

Apple Agriculture

Farmplan Computer Systems, Inc., PO Box 65, Campbell, CA 95009, has introduced to the U.S. market a family of software programs for farmers. Dairy Herd Management is a comprehensive system that handles detailed information about each cow's production and breeding records, for herds of up to 590 cows. The Pig Breeding Management program keeps accurate records for a herd of 60 boars and 600 sows with a maximum of 10 litters each. Crop Management provides a field-by-field, crop-by-crop management system; it creates crop budgets and cash flows, prints reports of resources required and used, and maintains records of field applications. Each of these programs costs $950.

The Least Cost Ration program lets the farmer develop least cost rations formulations for any animal operation. The price is $550. All programs run on Apple II+ microcomputers. Reader Service number 488.

6809 Macro Preprocessor

MAC95 is a useful tool for quick and error-free assembly-language program development. MAC95 lets the programmer create new instructions tailored to the application at hand. These new instructions (macros) are contained in text libraries and are copied into the MAC95 macro program before assembly. Each call to a macro is converted into a series of assembler instructions in order to pass the parameters associated with a macro to the macro routine. MAC95 then preprocesses the macro source into assembler source. MAC95 can be used with any assembler that is compatible with TSC's assembler and Flex. It supports position-independent programming techniques. The programmer has five addressing modes for use with a macro's parameters: direct, indirect, immediate, literal and register. All parameter addresses are communicated to each macro via the stack, allowing for reentrant programming. MAC95 requires 16K bytes of memory and Flex 9.0, and costs $50.

MAC Software, PO Box 1129, Duluth, GA 30136. Reader Service number 489.

Apple Pie Charts

Graph, an easy-to-use graphics software package, is the third member of the Personal Filing System line from Software Publishing Corporation, 1901 Landings Drive, Mountain View, CA 94043. This graphics package can stand alone or interface with PFS databases and VisiCalc to produce bar, line or pie charts of presentation quality in minutes. Line and bar graphs can be mixed and matched, and up to four graphs can be displayed on a single set of axes. Bar graphs can be stacked or comparative. Other features include automatic formatting, scaling, legend labelling and pattern fill. Graph runs on the Apple II+, and costs $125. Reader Service number 491.

Same Time Next Year

Right now, when most people are recovering from the annual struggle with tax returns, is a good time to plan for a better way. Two income tax preparation systems, designed to be used by professional accountants or individual taxpayers, are available on disk for CBM and PET microcomputers. The Professional Tax Preparation System handles regular or income-averaging tax returns, simultaneous separate returns and joint returns. It prints directly on 1040 long or short forms and schedules. Price is $800. The Personal Tax Calculation System is a scaled-down version of the Professional package, and calculates forms 1040 and Schedules A, B and G. It is priced at $69.95.

Commodore Business Machines, Inc., Computer Systems Division, 681 Moore Road, King of Prussia, PA 19406. Reader Service number 490.

Utilities

Dantek Software, Inc., 4550 Schoolhouse Road, Batavia, OH 45103, has announced HEXCOM, a set of four file-conversion utilities for CP/M-based systems. The utilities are HEXCOM, COMHEX, HEXROM and ROMHEX. Unlike the slower CP/M load command they replace, these utilities do not require sequential source-program addresses, thus saving programming time and reducing error. The HEXCOM and COMHEX utilities convert hexadecimal files into command files and vice versa. HEXROM and ROMHEX perform the same conversion function between hex files and ROM binary files. Cost of the package is $35. Reader Service number 492.

Professional Accounting

The Client Write-Up System, from INI, Inc., 4013 Chestnut St., Philadelphia, PA 19104, is a general ledger package for CPAs. Based on the Commodore CBM, the system boasts user friendliness, full reporting capabilities, 80-character type-ahead and a special budgeting interface with VisiCalc. Journal entries can be entered and edited using the system's full-screen editing. The program checks to be sure that account numbers are valid and that transactions balance. Reports cover any monthly, quarter-to-date or year-to-date balances from this year, last year or the budget, including ratios and/or variances, subtotals and account groupings. The accountant can organize his clients' charts of accounts in any way, grouping accounts together within schedules or breaking them down into subaccounts. The Client Write-Up system costs $850. Reader Service number 493.

Back-to-Basics Accounting

The general ledger package by Money Disk, PO Box 1531, Richland, WA 99352, is for the small business. No-Nonsense Books, for the Apple II+, is similar to high school double-entry bookkeeping, and takes about two hours to learn. The system is organized around 50 prenamed accounts, including two checking accounts. It maintains sales records in five profit centers for retail and wholesale accounting, complete records of each check written and all journal entries. Each transaction must be balanced before being accepted for recording directly to the ledger accounts. Printed records include sales summary and inventory turnover, operating summary, profit and loss, trial balance and balance sheet. The No-Nonsense Books package costs $225. Reader Service number 494.

Simplified Data Entry

Imput is a machine-language subroutine, called from Microsoft Basic (or other compatible language), which lets the programmer specify parameters for strings entered from the keyboard. Screen position, maximum length, acceptable characters, uppercase conversion, numerical

precision and automatic real-time numeric justification can all be specified before calling the routine. Imput also lets the programmer create input masks for ease of data entry; the entered data can be highlighted while the mask remains at standard intensity. Cursor controls and commands are preset to match other popular application programs, and can easily be redefined by the user to accommodate program or terminal requirements. Requires CP/M. Price is $79.

Paladin Systems, 2714 W. Ocean Front, Newport Beach, CA 92663. Reader Service number 495.

Space Game

Voyager Software, PO Box 1126, San Francisco, CA 94115, offers Starship Commander, a complex strategic space-battle simulation featuring 30 high-resolution color displays for the Apple II. As commander of the USS Ranger, a player must locate and destroy combinations of enemy destroyers, cruisers and dreadnoughts, using over 40 commands and 100 options to manage the crew, maintain power, maneuver the ship, make repairs, fire weapons and communicate with the enemy. A special feature of the game lets players send and receive messages from the enemy. The crew of 120 men and women can be assigned by name to each of three shifts; the ship also has 50 droids. Each of the ship's seven stations—Engineering, Science, Weapons, Defense, Communications, Life Support and Navigation—has its own display and command console. All commands are entered by paddle. A player can use manual or automatic systems control. The game includes a save feature. Price is $49.95. Reader Service number 496.

Ada for Micros

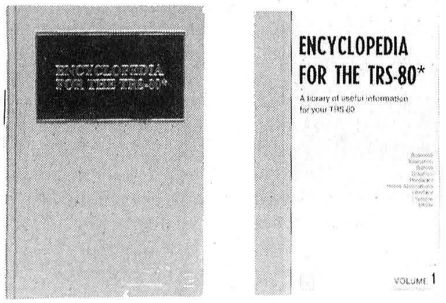
A native code, fully recursive, two-pass Ada compiler is available from SuperSoft, Inc., PO Box 1628, Champaign, IL 61820. Ada is the new language specified by the Defense Department for all programming and is certain to become a dominant computer language as a result, with broad applications in business and finance, education and mathematical applications. This highly structured, sophisticated language is also well-suited to systems programming. The SuperSoft offering is a subset that supports many features of the full Ada language. It requires CP/M. Price is $250. Reader Service number 497.

North Star Offerings

Four new software packages have been added to the financial and business library available from Omni Software Systems, Inc., 146 North Broad St., Griffith, IN 46319. All run under the North Star operating system and require 32K memory and disk drives. Business Financial Advisor is an income/expense data manager intended for use by the small businessperson. Its one-screen summary profit and loss display shows all billings and expenses, outstanding receivables and payables, gross and net profits, and estimated tax liability. It costs $95. Account Analysis permits posting to more than 60 different accounts, each one titled to the user's specifications. Any set of accounts can be compared with any other set and all data can be saved for future reference. The price is $75. DOC—The Word Processor provides a menu-driven text processor for $75. The Invoicer Plus is a general billing system for accountants, lawyers, consultants or any small business that sells a number of different products or services. It prepares invoices or statements on preprinted forms with descriptions and prices of up to 100 products or service procedures. Invoice Plus costs $95. Reader Service number 499.

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Visit our Computer Support Center for the Inland Empire's largest selection of ICs, books and computer accessories. Open daily. Check our prices and friendly service. **Inland Electro-Mart, 8624 California Ave., Riverside, CA 92504. 687-3776.**

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Your personal and business computer store for Dynabyte, Vector, HP-85, Atari and Epson. Structured Systems and Micro-Pro software. Computer furniture and books by Osborne or Hayden. Sales, service and supplies. **Computer Crossroads, 3800 S. Tamiami Trail, Sarasota, FL 33579. 349-0200.**

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Microcomputer systems for home or business; peripherals, software, books and magazines. Apple, Hewlett-Packard Series 80 Systems, HP calculators, IDS, Qume, Starwriter printers. **Farnsworth Computer Center, 1891 N. Farnsworth Ave., Aurora, IL 60505. 851-3888.**

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Try computer classifieds. Buy, sell, trade, employment, etc. No charge to read ads. 300 baud, 24 hours, 512-346-4495. **Oracle Systems, 8348 Summerwood, Austin, TX 78759.**

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Dealer in used computer hardware and electronic parts. Special on daisywheel printers. Xerox word processing equipment, dual card printers and display systems. Catalog $1. **Rondure Company, (The Computer Room) Dept. kb, 2522 Butler St. Dallas, TX 75235.**

Woodbridge, VA

Computer/word-processing systems for business, school, home. Software, disk drives, printers. Books, magazines, supplies. Authorized CBM/PET dealer, service. Consulting, training, maintenance contracts. MWF noon-8 PM, Saturday 9 AM-3 PM. **Virginia Micro Systems, Inc., 14415 Jefferson Davis Highway, Woodbridge, VA 22191. 491-6502. Washington Metro 643-1063.**

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Dealers: Listings are **$15** per month in prepaid quarterly payments, or one yearly payment of **$150**, also prepaid. Ads include 25 words describing your products and services plus your company name, address and phone. (No area codes or merchandise prices, please.) Call Marcia at 603-924-9471 or write *Microcomputing*, Ad Department, Peterborough, NH 03458.

Big Blue, Where Are You?

Microcomputing is looking for articles about the IBM Personal Computer. The magazine is inviting Personal Computer (PC) owners and users to share their knowledge of the system with the readers of *Microcomputing*

Have you made any improvements to the system or interfaced any interesting peripherals? Are you finding the necessary software for the system? Have you developed any programs or modifications of programs for use on the Personal Computer? If so, *Microcomputing* is interested in your experiences. Other articles ideas include:

- new developments
- unique applications
- undocumented features

Send your articles to: *Microcomputing*, Editorial Department, 80 Pine St., Peterborough, NH 03458. Author's guidelines to assist you with the preparation of your article are available by writing to the above address.

MICRO QUIZ

(from page 16)

Answer: 715

This program computes the value of "N objects taken R at a time":

$$\binom{N}{R} = \frac{N!}{R!(N-R)!} = \frac{13!}{9!\,4!}$$

CALENDAR

Applefest/Boston

The second Applefest/Boston will be held May 14 to 16 at Hynes Auditorium, Boston, MA. Show hours are 11 AM to 6 PM daily. The show will have over 200 displays and booths, plus seminars and panel discussions. Ticket prices are $6 per day or $15 for a three-day ticket.

Call or write National Computer Shows, 824 Boylston St., Chestnut Hill, MA 02167. 617-739-2000.

Micros in Education Workshops

The spring series of workshops, Microcomputers in Education, offered by the Technical Education Research Centers (TERC), will be held on May 18, 19 and 20 at Gutman Library in Cambridge, MA; and June 7, 8 and 9 at the Taft School in Watertown, CT. Ten one-day workshops are offered, designed for professional development for educators at all levels, elementary through college. Each workshop will emphasize hands-on experience with a variety of microcomputers.

For further information on these and upcoming workshops in other locations write: TERC, 8 Eliot St., Cambridge, MA 02138. 617-547-3890.

Conference on Technology and Special Education

The New York State Association for Educational Data Systems will sponsor a conference on computer applications in special education for administrators, teachers and parents on May 22. The conference will be held at the Mill Neck Manor Lutheran School for the Deaf, Frost Mill Road, Mill Neck, L.I., NY 11765.

For further information, contact Dr. Dolores Shanahan, Commack Public Schools, Indian Hollow Computer Lab, Kings Park Road, Commack, NY 11725 or Jerry Burke, Half Hollow Hills High School, Dix Hills, NY 11746.

Electro '82

Electro '82, an electronics exhibition and convention, will be held in Boston May 25–27. The theme of this year's program will be the "Electronics Frontier." Included in the events at Electro will be a professional program with sessions on topics such as research, medical electronics, robotics, speech recognition, memory and gate array. Exhibits and a communications conference are also part of the Electro program.

For more information call 617-232-4193 or 800-421-6816.

Interfacing and Instrument Automation Workshop

Virginia Polytechnic Institute and State University will hold a workshop on designing microcomputer interfaces May 31–June 4 in Blacksburg, VA.

For more information contact Dr. Linda Leffel, CEC, Virginia Tech, Blacksburg, VA 24061. 703-961-4848.

National Computer Conference

The National Computer Conference will be held June 7–10 at the Astrodomain, Houston, TX.

Registration must be received by May 3. To register write to NCC '82 Registration, AFIPS PO Box 9658, Arlington, VA 22209. For further information call 703-558-3608.

Swapfest in St. Paul

The North Area Repeater Association will sponsor the state's largest swapfest and exposition of personal computer and communication equipment on June 5 at the Minnesota State Fairgrounds, located on Snelling Ave. north of I-94. Exhibits, booths and prizes. Admission $3.

For more information or reservations write Amateur Fair, PO Box 30054, St. Paul, MN 55175.

National Computer Graphics Association Conference

The third annual National Computer Graphics Association conference and exposition will be held June 13–17 in Anaheim, CA. Tutorials, technical sessions and exhibits make up the conference program.

For further information contact NCGA, 2033 M St. N.W., Suite 330, Washington, D.C. 20036. 202-466-5895.

Computerfest '82

The Midwest Affiliation of Computer Clubs is sponsoring the seventh annual Computerfest, June 18–20 at Franklin University, Columbus, OH. Computerfest will include lectures, demonstrations, exhibitions and a flea market.

For more information contact M.A.C.C., c/o Professor Don Moore, 201 South Grant Ave., Columbus, OH 43215.

MIT's Computer Music Courses

The Experimental Music Studio at the Massachusetts Institute of Technology will offer its sixth summer session from June 21 to July 30. The session consists of two complementary workshops. The first, Techniques of Computer Sound Synthesis (June 21–July 2), explores the latest developments in digital audio processing. The Workshop in Computer Music Composition (July 5–30), allows composers to use the computer as an expressive musical instrument. The courses are designed to provide participants with extensive hands-on experience using the studio's facilities. No special technical knowledge is required or assumed.

For application information, contact Director of the Summer Session, Room E19-356, Massachusetts Institute of Technology, Cambridge, MA 02139.

Basic Training Camp

Lake Forest College will sponsor a series of one-week computer camp sessions from June 20–Aug. 6. The sessions are open to all youngsters 12 to 18 years old and will focus on the Basic language.

For more information contact Dr. Lowell Carmony, Associate Professor of Mathematics and Computer Studies, Lake Forest College, Lake Forest, IL 60045. 312-234-3100.

Videotex '82

The Videotex '82 Conference will be held June 28–30 at the New York Hilton, New York City.

For information contact Online Conferences Ltd., Argyle House, Northwood Hills, HA6 1TS, Middlesex, England, United Kingdom. Northwood phone: (09274) 28211; international phone: 44-9274 28211; Telex: 923498; cable: Online Northwood.

National Computer Camp

National Computer Camp will be held in Simsbury, CT from July 11–Aug. 16 for youngsters ages ten to 18. In addition to learning about computers, children will have an opportunity to enjoy recreational activities including swimming and tennis.

For more information contact Michael Zabinski, Ph.D., National Computer Camp, PO Box 624, Orange, CT 06477. 203-795-3049.

Origins '82

Origins '82, the eighth annual national Adventure Gaming show, will be held July 23–25 at the University of Maryland, Baltimore, MD. This gaming convention will include exhibitions, tournaments, seminars and demonstrations.

For more information contact Origins '82, PO Box 15405, Baltimore, MD 21220. 301-539-4634.

Peripherals '82

The first International Peripheral Equipment and Software Exposition (Peripherals '82) will be held Sept. 29, 30 and Oct. 1 at the Anaheim Convention Center, Anaheim, CA.

For more information on exhibiting or visiting Peripherals '82 contact Cahners Exposition Group, 222 West Adams St., Chicago, IL 60606. 312-263-4866, Telex: 256148.

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Classified advertisements are intended for use by persons desiring to buy, sell or trade used computer equipment. No commercial ads are accepted.

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Advertising text and payment must reach us 60 days in advance of publication (i.e., copy for March issue, mailed in February, must be here by Jan. 1). The publisher reserves the right to refuse questionable or inapplicable advertisements. Mail copy with payment to: **Classifieds, *Microcomputing*, Peterborough, NH 03458**. Do not include any other material with your ad as it may be delayed.

FREE machine-language monitor for Elf II. Does all that the Netronics monitor does plus more and uses the terminal, not the hex keypad. Runs in 1.25K and can run from a PROM. Has a 300 baud software UART and a parallel printer out routine. Please send name and address with $2 to cover reproduction and mailing to: John Ware, 2257 6th Ave., Ft. Worth, TX 76110.

For sale: 200ns 4116 16K RAMS. High reliability ceramic pkg. Rplcmnt guar. $16/8, $30/16 or $55/32. Include $2 for postage to: K.D. Gennetten, 1431 Tarryton Drive, Ft. Collins, CO 80526. 303-226-1395.

For sale: Centronics 779 dot matrix printer. Features: 60 cps, up to 132 columns, RS-232 interface, parallel interface board, $350. 617-227-5813.

Heath H9 video terminal modified for 24×80 and upper- and lowercase character entry and display, $275. Also SWTPC AC-30, $20; ASCII keyboard, $25; many parts including 6800s and I/O chips. Heath HW101 SSB transceiver with HP23A power supply, $425. SASE for complete list. T. Glaser, Rt 1 Box 312, Rochester, MN 55901. 507-285-9871.

For sale: Apple Silentype printer, $280. Puchased new in Nov. 81 but no longer needed. R.L. Henne, 5870 Wood Flower, Burke, VA 22015. 703-250-5323.

Microtek MT-80P printer. Excellent condition. Two years old. Originally $900+. Priced at $500 for immediate sale. I will pay shipping. Irv Brechner—201-731-4382 up to 9 PM, eastern time please.

Used Heath H-8 memory board, I/O card, terminal, software and complete H-8 system. Ten to 50 percent off list price. Send for free listing. D. Wong, Box 406, Groton Fall, NY 10519.

Elf II with giant board, 8K memory, terminal, complete software package, and manuals, $400. Steven Powell, 12607 Wellington Park, Houston, TX 77072. 713-495-0488.

IBM 2970 Selectric I/O computer terminal $325, 35 Teletype $60. Call 608-582-4124 for Kurt.

TRS-80 user's group gives FREE sample newsletter. Reviews programs right for YOUR needs. Avoid ripoffs. Send 37¢ stamped SASE. Software Review(TM), 92 Washington Ave, Cedarhurst, NY 11516.

For sale SWTPC 6800/2 system. MPA2, BOAZ D64KB(32K), MP8M, MPS, F&D PMB1, AC30, CT1024, MPLA, PR40, MF68, DC1, MPR. Bare boards MPS, MPLA, MPT and MP09A. Assorted software. 901-795-5122 evenings.

CLUB NOTES

Apple User's Group

The Apple User's Group (Sydney) meets at the Sydney Grammar School, Science Auditorium, on the second Monday of every month at 6:30 PM. The group maintains a software library on disk and publishes a monthly newsletter, *Applecations*.

For further information contact A.U.G. (Sydney), PO Box 505, Bankstown, N.S.W., 2200 Australia.

Computer-Chip Experimenters

The Association of Computer-Chip Experimenters (A.C.E.) meets the second Tuesday of each month, Sept. through June at 7:30 PM, room B123, Sheridan College, 1430 Trafalgar Rd., Oakville, Ontario.

For more information write to A.C.E., c/o Bernie Murphy, 102 McCraney St. East, Oakville, Ontario, Canada, L6H 1H6. 416-845-1630.

MUMPS User's Group Meeting

The annual MUMPS User's Group meeting will be held June 7–11 at the Denver Hilton, Denver, CO.

For registration information contact Professional Associates, Charles White, 2012 Big Bend Blvd., St. Louis, MO 63117. 314-781-9192. The call for papers is available from MUMPS User's Group, Box 37247, Washington, D.C. 20013. 301-779-6555.

Long Island Computer Association

The Long Island Computer Association meets the third Friday of each month at 8 PM in room 508, building 500, The New York Institute of Technology, Old Westbury Campus, Hicksville, NY.

For more information write to L.I.C.A., PO Box 71, Hicksville, NY 11802.

SS-50/6800 Newsletter

A non-profit newsletter and products directory with hardware and software information about SS-50/6800 computers has been organized in England.

For more information send a S.A.S.E. to T.K. Boyd, Belmont School, Feldmore, Holmbury St. Mary, Dorking, Surrey, RH5 6LQ.

New Zealand Micro Club

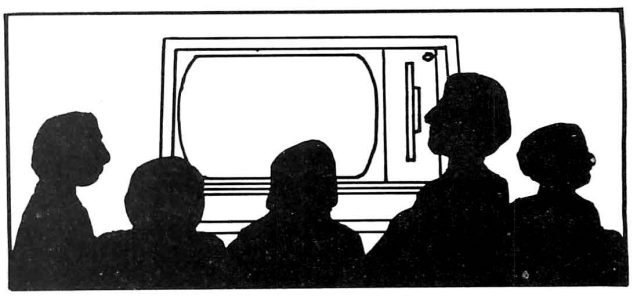
The New Zealand Microcomputer Club meets several times a month in Aukland.

For more information write to N.Z. Microcomputer Club, PO Box 6210, Aukland, New Zealand.

Capital Area TRS-80 User's Group

The Capital Area TRS-80 User's Group meets the third Wednesday of the month at Computerland.

For further information write C.A.P.A.T.U.G., c/o Computerland of Harrisburg, 4644 Carlisle Pike, Camp Hill, PA 17011.



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4010	.45	4048	.75	4510	.95
4011	.35	4049	.55	4511	.95
4012	.35	4050	.55	4512	.95
4013	.45	4051	.95	4514	2.25
4014	.95	4052	.95	4515	2.25
4015	.95	4053	.95	4516	1.50
4016	.45	4055	2.75	4518	1.25
4017	.95	4056	2.75	4519	1.25
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4019	.45	4060	1.25	4522	1.25
4020	.95	4066	.75	4526	1.25
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4022	.95	4069	.40	4528	1.25
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4024	.75	4071	.30	4532	1.75
4025	.35	4072	.30	4539	1.75
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4032	2.75	4085	.95	4581	1.95
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(from page 162)

used the Applesoft graphics commands will be able to understand Ampergraph commands readily, though they will probably have to consult the sample programs in the back of the manual. Beginners will find Ampergraph commands easier to learn than, say, Fortran commands; but they can count on a few hours of trial and error learning before they master the Ampergraph commands.

But the user's manual is not clear about one important point: the Ampergraph utility works only on page 2 of the high-resolution graphics. In other words, every program must contain the command HGR2. If either the low-resolution graphics or page 1 of the high-resolution graphics is used, the results are unpredictable.

Who could use Ampergraph? Anyone who would rather pay $25 for a graphing utility with hard-copy capabilities than spend hours writing custom programs with the frustrating Applesoft commands. That should include a lot of mathematicians, a lot of statisticians and a lot of businessmen.

But potential buyers should be aware of three weaknesses. As already mentioned, the only practicable printer for many users will be Apple's Silentype, a thermal printer which does not produce neat 20-pound-bond originals. Still, photocopies of the thermal originals are often acceptable.

Also, mathematical purists will be disturbed because the horizontal and vertical axes are not scaled on the same metric. In other words, an interval of (say) one centimeter on the x scale will not be an interval of one centimeter on the y scale. In some applications, this is a serious weakness, although it can be overcome by careful (and tedious) trial-and-error programming of the scales.

Finally, the printed copy, like the Apple CRT screen, is only 40 columns wide. There are occasions when a decent graph should fill a complete 8½ by 11 page (my own rule is that it is better to make a graph too big than to make it too small, although this rule may merely reflect the limited power of my bifocals).

So Ampergraph will give you ample graphing power—and that's it. You certainly can't complain about the price, and the limitations of the utility aren't that serious if all you're after is the occasional graph to complete a college term paper or a scholarly handout for next year's dull conference.

(Since this review, Madwest Software has come out with version 2.0. The only change in this new version is a provision for interfacing the utility to an Epson MX-80 or MX-100 printer. The interface requires a second utility, Amperdump (price, $30); I did not test this second utility, but it's supposed to provide printouts up to 7 × 8 inches in size—about 4 times the area of the printouts available from the original version. It is not clear from the documentation for Amperdump whether it will work with programs other than Ampergraph; if it does, it might be a helpful utility for users who want graphics output on their Epson printers.)
(Madwest Software, PO Box 9822, Madison, WI 53715. $30.)

Brownlee Elliott
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The Documenter

A TRS-80 program
Lets your computer
Create your flowchart

Flowcharts rarely accompany software. In fact, I've bought only one program that included a flowchart with the documentation.

The absence of a flowchart can cause problems if you want to make changes in the program without interrupting the program logic. The Documenter by P8ONUT software (pronounced "peanut" or "double-Pnut") has approached this problem by providing a logical flowchart of any Basic program.

Once loaded, The Documenter runs through any Basic program in memory and produces a flowchart of the program. The flowchart is displayed on the CRT and can be printed. If you have a graphics printer such as the MX-80, the flowchart symbols are printed in graphic style. In the case of a nongraphic printer, the symbols are printed using characters such as : or ;. In addition to the flowchart output, The Documenter prints a list at the end of

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the chart, including Branch From, Function and Branch To. Besides working with different printers, The Documenter lets you display continuously or one screen at a time. The same feature is available for the printer so that only those sections you want can be printed out. You can selectively chart by stating the line numbers to be charted.

The Documenter also lets you return to the Basic program any time you desire. You can then list or edit the program and return to The Documenter. The only restriction is that you cannot run the Basic program. That destroys The Documenter, which is not in protected memory.

```
10 REM TEST OF THE DOCUMENTER
20 REM START LOOP
30 FOR X = 1 TO 100
40 PRINT" THE DOCUMENTER "
50 REM STOP THE LOOP WHEN PRINT HAS BEEN DONE 10 TIMES
60 IF X < 10 GOTO 70 ELSE 80
70 NEXT X
80 STOP
```

DOCUMENTER OUTPUT

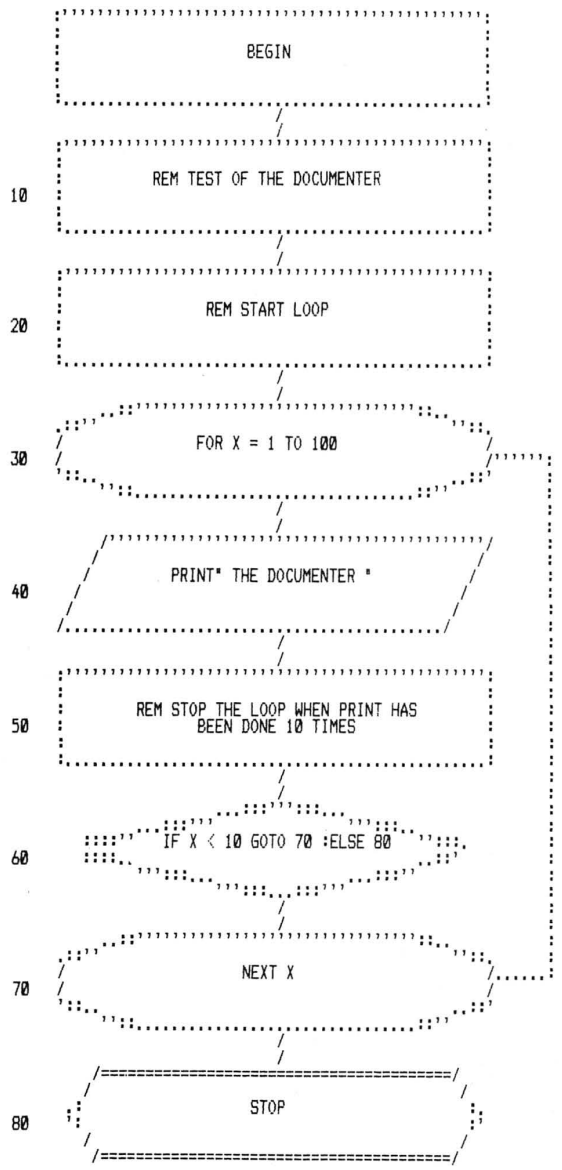


Fig. 1. Test program and flowchart.

I've noticed several problems with The Documenter. First, it won't run on my computer. I have a TRS-80 Model I Level II 48K with disk. My keyboard contains the very first Level II ROM. I don't know if that's the problem, but The Documenter will begin to run and then, after a short time, locks up. Luckily I have two computers, and when I exchange keyboards the program runs fine. The second keyboard contains the most recent Level II ROM.

Second, as the documentation notes, The Documenter only charts from the top down. It does not permit horizontal branches. This poses a few minor problems in the logic flow, but it can be overcome. It is certainly better than no flowchart at all.

Third, The Documenter is designed to run under TRSDOS 2.3; there are incompatibilities with NEWDOS80 on the Model III. I've used NEWDOS80 on the Model I, and The Documenter seems to function fine, but there may be some problems I haven't run into yet. In either case, the people at P80NUT are working on the problem, and expect compatibility to be complete soon.

Last, The Documenter obviously can't supply words for describing the program logic. It must depend on reprinting lines of code or REM statements from the program. In fact, what it does is take each line, determine its content and then print or display the line or part thereof inside the proper charting block. Since room in these charting blocks is limited, some of the code and REM statements may be cut off. This occurs in a most confusing manner in compressed programs or extremely long lines. The best way to avoid this problem is to unpack tightly-written programs with a utility such as Packer by Cottage Software.

Fig. 1 is a short Basic program and The Documenter's flowchart. The branch chart normally at the bottom of the print is not included since the program is so short.

"The Documenter" is a new program, and like all new programs it may still have a few bugs. I've talked to the people at P80NUT and they want to produce a good product.

As always, you should be certain that you need the program before you buy it. If you can use the aid of flowcharting for your programming, The Documenter may be what you're looking for. It's certainly an ingenious approach to program documentation.

(P80NUT Software, Box 490, Lilburn, GA 30247. $19.95 for 16, 32, or 48K tape, $29.95 for 48K disk.)

Richard C. McGarvey
Wiliamsville, NY

Mychess

For the Heath micros:
A chess program
That ranks with the best

When considering a chess program, the first, and perhaps most important, feature is the strength of play. Based on tournament time limits (40 moves in two hours), Mychess for the Heath has a United States Chess Federation (USCF) ranking of 1568 (the average ranking is about 1400). Mychess won the fifth West Coast Computer Faire (1980) tournament, and was the top finisher among microcomputers in the tenth ACM North American Computer Chess Championship (1979).

I've played many games against Fidelity Electronics' Chess Challenger 10 and Sargon I, and Mychess is a stronger opponent. In fact, when Mychess is playing at one of its higher levels, most people would consider it unbeatable.

The skill level of Mychess ranges from 1 to 9. This number is the ply level, or the number of half moves that the program looks ahead. The speed with which Mychess moves is, of course, related to the selected skill level. At level 1, Mychess takes about 5 seconds per move, at level 2 about 15 seconds, at level 3 about 40 seconds and at level 4 about 4 minutes. It will play about 6 times slower at each additional level. This means levels 5 through 9 are extremely slow and not very practical. Strong-playing, but slow, levels are common to almost all computer chess programs.

Mychess uses the standard algebraic notation to represent each square. With this method each row is numbered 1 through 8 and each column is labeled A through H. These numbers and letters are used as the column-row coordinates for each square (white's king's pawn begins on square E2). After you've been prompted to enter your move, you simply key the coordinates of the square containing the piece to be moved, followed by any character (usually a hyphen) and the coordinates of the square to which the piece is to be moved. Any mistakes can be corrected by using the backspace key. Striking the return key will tell Mychess to process the move.

When Mychess moves a piece or pieces, it erases the piece from its current square and redisplays it at its new square, removing any piece which might have been captured. Of course, Mychess will not accept any illegal moves. When Mychess makes a move it will sound a "beep" on the speaker to notify the user. This is a helpful feature especially when playing on one of the slower levels.

This version of Mychess makes excellent use of the H89/H19 graphics. The board is positioned on the left side of the screen and occupies the full length of the screen (25 lines) and about two-thirds of the width (52 columns). Two columns on

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the left side of the board and two columns on the right are used to display the numbers (1–8) representing the board's rows. The bottom line is used to display the characters (A–H) used to represent the board's columns. This labeling is helpful during the game because the user doesn't waste his time counting rows and columns when entering his move. The squares of the board are solid black and white.

The pieces are well-defined and look much like standard chess pieces. The method that Mychess uses to display a white piece on a white square and a black piece on a black square is nicely done and not at all confusing.

The moves made by both players are displayed on the right third of the screen. When it's your turn to move, you are prompted by the words "You play:" followed by the move number. Mychess then makes its move and on the next line prints "I play:" followed by the move number, the string "— —" and the notation for its move. Immediately to the right of its move, "check" will be printed if its move has indeed placed the user in check. Because of the limited amount of space available, the moves are bunched together, giving them a cluttered look and making them somewhat difficult to read.

Another feature of Mychess is the ability to set up a board position. If you decide to use this feature, Mychess will display the board setup for the beginning of a game. You must then enter as many moves as is necessary to arrange the board. These moves may be illegal, but the receiving square must be occupied. A piece may be removed from the board by entering its square and no receiving square. When the board has been set up as desired, typing the return key will get you out of this mode. Mychess will ask for the castling status of each side, and the move number.

Setting up a board position is always somewhat cumbersome, but this method deals rather well with the situation. However, if you accidentally remove a piece, you can't put it back. A more practical method would be to start with an empty board and have you enter a square's coordinates and a code indicating the type of piece and its colors. By entering a square's coordinates only, you could remove a piece that has been incorrectly positioned. This method would not only reduce the number of entries, but would also allow you to easily correct any mistakes. Some additional program code would be required for this method, making the program larger, whereas the current method being used by Mychess can make use of existing "move" routines.

Mychess also uses time controls. You can tell Mychess to make the first 40 moves in 120 minutes and the next 20 moves in 60 minutes, thus simulating actual tournament play. You must keep track of the time, and Mychess will occasionally ask how much time it has remaining. Mychess will play at the 4 ply level but will drop to level 3 if time becomes a factor. Time controls make the game seem more realistic; however, it would be even more realistic if the program could keep track of the time for both players.

One very important feature of Mychess is your ability to force Mychess to make a move. By entering "GO" while Mychess is determining its next move, you can tell it to make the best move that it has found up to that point. This is useful when playing at one of the higher levels, as most people have neither the time nor the patience to play a five hour game.

Other command options let you make more than one move at a time, switch places with Mychess and make Mychess play against itself. Although these options are not part of a normal game, they let you use Mychess as an instructional tool.

The final options available to you are the ability to record the moves on a printer and the ability to have Mychess tell you what sequence of moves it considers best.

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One very impressive fact about Mychess is that it will predict its opponent's next move and begin determining its reply while it is waiting for the opponent to enter his move. This is a feature that many microcomputer chess programs lack.

If you're looking for a chess program to add to your microcomputer system, I think you'll be pleased with Mychess.

(The Software Toolworks, 14478 Glorietta Drive, Sherman Oaks, CA 91423. $34.95. Available for HDOS and CP/M; requires 48K of memory.)

Frank Bowers
Blacksburg, VA

Diagnostics II

A program for CP/M Lets your computer Diagnose its own ills

The idea of letting my computer diagnose its own ills fascinates me. My limited programming ability, though, has held me back. I've continued to rely on the tools of the hardware hacker—schematics, a soldering iron and an oscilloscope. Supersoft's Diagnostics II for CP/M-based systems has changed this.

Diagnostics II consists of 15 programs, which are called as CP/M.COM files. For instance, to run the first memory test, you simply enter MTEST; the program loads and then executes. (I'm annoyed, though, that Supersoft uses a menu type program but doesn't produce a menu on the screen.)

Supersoft uses two gimmicks. First, a disk file contains a copy of the manual. This can be read by the CP/M TYPE command. The second is the HELP.COM file, which is a menu-driven companion to the program. Supersoft certainly plays this up in its ads. Unfortunately, when I tried to run it in a 40K CP/M system, the error message showed that the program exceeded my memory. I expanded to 48K with the same result. In desperation I borrowed 12K and tried to run the program with 60K. Again, no luck. Since I consider these features to be superfluous, I haven't bothered to complain to Supersoft. This problem does show a lack of care on the manufacturer's part, since Diagnostics II is supposed to run on a 32K CP/M system.

Supersoft includes two memory tests, MTEST and MTEST2. As anyone else who owns 48K of Processor Technology's dynamic programmable random access memory (RAM) will know, testing memory is an essential part of computing. Collecting memory test programs becomes a hobby in itself; writing memory test programs becomes an obsession.

MTEST2 is the simplest to explain. It is a relocated version of MTEST that tests the area of memory that would normally be filled with MTEST. Unfortunately, I don't know how well it works since every time I start it, it hangs up with the message that drive C is not up. This is very observant of it, since I don't own a third drive. I haven't bothered with this problem; I assume that since MTEST works, the memory in which it resides must work, too.

MTEST consists of four memory tests.

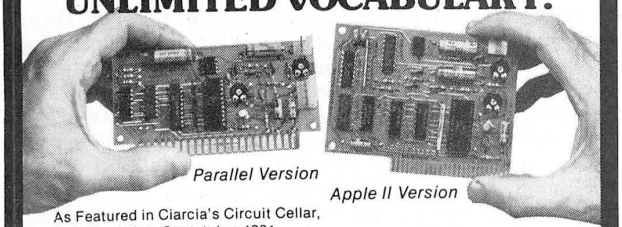
The quick test tests memory one byte at a time. An address is written to and read from; if there is no error, the program moves on to the next byte.

The walking test is much more comprehensive and therefore much longer. It takes 13 hours to test 16K. In this test, not only is the addressed byte written to and read from, but all the other bytes are read from to make sure that they were not affected by operations on other bytes.

A third burn test is meant specifically for dynamic memory and picks up afterimages. My flaky memory is certainly a challenge for any memory test, so I can reassure any user that the quick test is sufficient to pick up any but extremely subtle errors.

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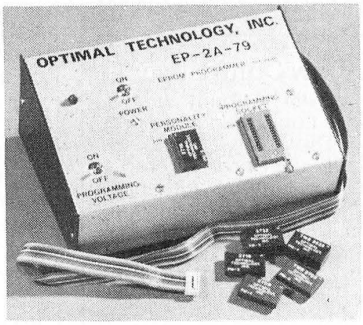
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> Supersoft has developed a very useful group of programs, which are useful to hardware freaks like me.

your memory is running at 2 or 4 megahertz.

All memory tests will handle bank-select boards.

The program displays instructive messages when it finds a memory error. From this information, any competent electronics hobbyist should be able to correct the problem. You can even save error messages on disk. This way, you can leave the program running unattended and read the results later (remember the 13-hour memory test?).

Supersoft is prouder of their central processing unit (CPU) test than the routine justifies. Their ads say it's the only diagnostic routine that tests the CPU. Can there be a hidden message there? If there is anything seriously wrong with the CPU, you can't load, let alone run, the program. Supersoft, however, says that some seldom-used op codes may misfunction without your knowing it. So be it.

The test starts by telling you what type of processor you have. If you aren't sure of this to start with, you don't belong under the cover with a screwdriver. The program shows that I have either an 8080 or an 8085. Then a timing routine determines the speed of the machine. Again, it's of limited use.

To my surprise, the screen message told me that my F register was not working. Fortunately, being a hardware hacker, I realized that the 8080 has no F register. A peek at the manual showed me that the F register really is the program status word (PSW). So why not say so on the screen? Examination of the error message showed that the program was trying to change bits in the PSW that can't be changed in the 8080.

Further along, the manual informed me that the CPU test could hang up on this problem. Although a fix is suggested, it shouldn't be tried if you aren't familiar with assembly-language programming. I understand this problem has been corrected in an update Supersoft is now offering for $25.

The disk test is the best of the package. A pattern of bits is written to the disk in either a random or user-determined order and then read back. You determine which tracks and sectors are to be tested and in which order.

I'm annoyed that you must use decimal notation here while the memory tests use hexadecimal addresses. This may not sound like much, but it smacks of amateurism. Use a formatted, empty diskette for this test: the program destroys any material saved on the disk.

Once again, there are many helpful error messages. Give Diagnostics II and 3M's disk cleaning kit to your disk drives as a peace offering.

The printer test seems versatile. I unfortunately don't own a daisywheel printer, but, if the program tests them as well as it does my standard Selectric printer, you have nothing to worry about.

Finally, you test your terminal. To anyone who knows the hardware and software mechanics of his system, it's a snap. However, the options that you must supply will be very confusing to anyone who doesn't know these things. Even Supersoft's usual hand-holding won't help here.

The program requires a data file with the details of your specific terminal. The maker has included files for the Soroc, ADM-3, Hazeltine 1500 and ADDS Regency terminals. If you have another one, you must create your own file the first time you use the program. The manual and screen prompts are explicit, but you must know many technical facts about your terminal, such as the hex sequence for load cursor position and the decimal value for the top line of your display. I know these for my terminal, but do you know them for yours? If Lifeboat Associates can supply configured forms of their CP/M software, I don't know why Supersoft can't do the same.

Enter QRUN and you're into the quick test. First, it tests all memory in the transient program area (TPA) of CP/M. Then, a quick disk check is done and finally the CPU test executes. There are two problems. First, no one tells you what the quick disk test does to the disk in the drive. In fact, the test does not destroy any data, but I wish Supersoft had reassured me about this first.

The second problem is my old friend, the CPU test. It always hangs up with the statement that the F register isn't working! But I wouldn't consider using my computer without first running this test.

My one complaint is quality control. Software manufacturers rightly complain that we hobbyists resist paying realistic prices for professional software. I, however, resent it when I pay and then get a program in which two of the programs don't work. I burn when I later get a letter advising me that I can correct those errors by buying an update that costs one quarter of the original package.

Supersoft has developed a very useful group of programs. They have shown their usual care in the writing of the manual and, as usual, lead you through each step by the hand. The program is useful to hardware freaks like me, and it would be useful to any repair shop. The quick test is invaluable as something to be run

before you start using the computer every day.

(Supersoft Associates, Champaign, IL 61820. $99.)

Bruce R. Evans
Pickering, Ontario

Print II

This Apple utility
Lets you format
For numerical output

Computer journals have published many articles that extend the capabilities of various computer languages. One such extension to Applesoft is a formatting feature for numerical output (see, for example, *Micro*, Vol. 27, 1980, or Call A.P.P.L.E. In Depth, Vol. 1, 1981). Some versions of Basic refer to this as a Print Using statement, a statement that allows a value to be printed using a specified format. The Print II utility by Computer Systems Design adds just such a formatting capability to Applesoft, and also provides for cursor positioning from within a Print statement.

Print II is a machine-language routine that is loaded just below DOS. Applesoft recognizes three new forms of the Print command, including Print For, Print # and Print At. The Print For statement lets you designate a format to be used for subsequent numeric output. This includes the specification of the total number of digits to be output and the number of digits to the right of a decimal point. In addition, you can specify a leading character ($, #, %, or "). Another option lets you replace leading blanks with asterisks. Once specified, a format can be reused repeatedly in Print statements by preceding a numeric expression in a Print statement by the symbol #. The format can be changed by issuing another Print For. The Print At statement allows X, Y cursor positioning from within a Print statement.

Essentially, the Print II utility lets you output numeric values according to a specified format at a selected cursor position. These capabilities greatly simplify the display of tables of values. Also, though it is not mentioned in the brief documentation that accompanies the Print II package, these commands can be used for output to a printer, with values printed according to the specified format and horizontal tabulation determined by the Print At command (vertical tabulation is ineffective with printer output).

Print II is supplied on a DOS 3.2 disk (it can be muffined to DOS 3.3), which contains programs to customize Print II for specific memory configurations and several simple demonstration programs.

Print II lacks the versatility in print formats that are available in some forms of the Print Using statement, but it is easy



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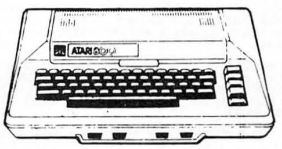
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Larry P. Gonzalez
Chicago, IL

Full Disk Sort/Merge

A package for 6800s
Offers sorting capabilities
At a reasonable cost

Full Disk Sort/Merge from Star Kits is a disk file sorting program that handles files up to full disk capacity and creates a new sorted file. It is designed for the 6800 system using dual Percom disk drives and Super Basic.

The program itself is written in Basic and is easily converted to other versions of Basic or disk operating systems. While it runs slower than the available machine-language packages, it is available at a reasonable cost and is easily modified by the user.

The comprehensive documentation begins by defining files, records, fields and the key to the sort. The program is described in enough detail for a beginner to easily use it the first time it is run.

Sort/Merge organizes disk data into a sequence specified by the user. The program is useful for organizing business data, experimental results, mailing lists, record collections, libraries and inventories.

Sort/Merge can sort a data file of up to ten fields per record. This value can easily be changed. The file is sorted with a sorting key you define. This can be any combination of fields with numeric or string data. The fields can be sorted in increasing or decreasing order.

File definition is the first stage of the program. It asks for the name of the source file to be sorted, the number of fields in each record, type of field (numeric, string or any combination), the manner in which the sort is to be structured (up to ten fields) and if specific data should be selected or deleted from the sort.

The input disk is placed in drive 1 and a blank, but initialized, disk is placed in drive 2.

The efficient Shell-Metzner sort routine forms the main program. Small files are sorted in memory in a single operation. A 32K system will sort 50 records, of four fields, in memory with no need to merge files.

Files too large for memory are broken into smaller segments. These are individually sorted and combined (merged) into longer segments. This process continues until a single sorted file results. The merging operation requires two disk drives if the files are larger than half the capacity of the disk.

Once the file is sorted, a new file is written on a separate disk. Sort/Merge never updates a file in place; rather, a new file is created. This is especially desirable in critical applications to protect the data from being lost by a system failure or an operator error.

The Full Disk Sort/Merge package is delivered on a single 5-¼ inch disk. Along with the fully documented source program and the detailed instruction handbook, there are three test files and a print utility to show the results of the test files after they are sorted.

Since the files are ASCII data created by Basic or an editor, the only restriction is that a comma must be used as the field delimiter and not part of the data. Also, since the files are ASCII, data in lowercase characters will appear after data in uppercase characters.

To get an idea of the time required by the program to sort a file, I sorted a ten record file of three fields in a single operation in 20 seconds. A 100-record file of five fields was sorted on two fields; this required four minutes to sort and 1½ minutes to merge into the finished file.

Star Kit's Full Disk Sort/Merge program is a worthwhile investment for anyone who uses disk data files that must be sorted into a determined order for easier analysis.

(Star Kits, PO Box 209, Mt. Kisco, NY 10549. $35.)

Dennis Doonan
Racine, WI

Inventory Management System

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At the top of a businessman's pile of worries, you'll always find inventory. No matter what business you're in, if you don't have what a customer wants to buy, when he wants to buy it, you might as well close up shop.

But the paperwork! The time! The trouble!

So, when microcomputers came rolling off the assembly lines, many businessmen were waiting to buy one, eager to let their new Apple or PET or TRS-80 handle all of those inventory problems.

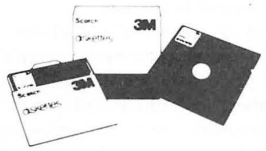
This is terrific, if the businessman is able to program his own inventory system. But what about the guy who doesn't know a byte from a ROM and doesn't want to?

Hayden Book Company, along with JACC, Inc., had this businessman in mind when they produced a $175 program for the Apple called the Inventory Management System for Stock Control.

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up to 4808 items—a huge number.

The literature claims that IMS can do its thing rapidly, due to a "unique machine-language database," and that you'll "be assured of trouble free inventory control."

Well, almost.

Oh, the system does work, and it does what it says it'll do. Once your files are set up, they're easy to maintain and work with. The reports are fast and accurate. But, like any other noncustomized program, it has some built-in limitations. Which means the IMS system will work for you if you're willing to accept those constraints and work within them.

The biggest difficulty with IMS is that the system seems to be designed from a programmer's, rather than a businessman's, point of view.

You get your first hint when you discover that for IMS to handle so many items, it needs six disk drives. The program handles about 800 items per disk, but each disk has to be in its own drive.

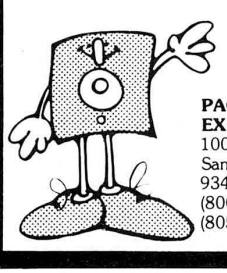
It would have made more sense to keep 800 items per disk, but make the program go from disk to disk; then it could be run using an unlimited number of items with only a single disk system. In today's market, it doesn't make economic sense to buy six disk drives (which, using DOS 3.2, would allow you about 600,000 bytes of data online), while you could buy a fixed disk system for roughly the same price with almost ten times the storage capacity!

So, count your inventory items, and be aware of the fact that using this program, you'll be limited by the number of disk drives you have.

The manual is reasonably well-written, although without an index. There's some elementary advice on handling and inserting diskettes, which is good for the first-time user.

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This program keeps track of all sales from inventory, per item, for a six-month period.

They also allow you to format a disk and put sample inventory information on it. This is a great idea, and lets you work with the system using 'phoney' data, so you can't hurt it if you do something wrong. It lets you become familiar with all aspects of the system before you start with your own information.

You'll discover when running your practice sessions that when you enter information for a new item, it's automatically saved, without giving you a chance to correct the data. You can skip to a different part of the program to modify the information, of course, but it would have been easier to let you correct the data as it's put in. And once you put the part number in, you're never allowed to change it. This could be a problem if your numbering system changes sometime in the future.

I suspect the reasoning behind this programming method is to protect the stock numbers from the person using the system. But if you trust someone enough to let them change the numbers for items in stock, adjust prices and so on, you might as well trust them not to mess up the part numbers.

One helpful feature IMS provides is the capability to help you find a part, even if you only know the first part of its stock number. IMS will display (or print) all the items that start with the partial number you give it. So, if you know that the item you want to see starts with mic-, the program will list all the items that have mic- as the first part of their stock number.

You're allowed to have 21 characters for each part number, and 27 for each description. You can also use substitute part numbers (15 characters), the manufacturer's name (14) and the manufacturer's part number (14). Of these, the only one that might be a little small is the manufacturer's part number—they can get a bit longer than the 14 characters allowed.

When you add a new item to your inventory, IMS will automatically check to see if that number is in use—a good feature.

One of this program's main benefits is its ability to keep track of all sales from inventory, per item, for a six-month period. It'll display or print a consumption record for each part, so you'll not only know what is selling but when it is selling. IMS also provides an excess stock printout (excess stock is considered to be the stock on hand, less two months of normal use). You can also get a printout of what's not selling at all.

The Inventory Management System will also keep track of back orders; they can be either items you're waiting to get from a supplier, or items you still need to deliver to a customer (you can decide which definition you'll use, but you have to be consistent in its use).

But with all the reports available, you can't get a simple printout you could use for your price list—something like the part number, description and retail price. This is another thing a businessman might think of and want, but a programmer might not consider.

The other major difficulty, from a business standpoint, is that IMS does not provide for the use of purchase orders. Any business of any size uses purchase orders to not only verify their ordering, but to keep track of items. IMS does indicate that an item is on-order, and on what date it was ordered, but doesn't do a thing to tell you where you ordered it from. Most businesses have more than one supplier for everything they sell, even though one might be the primary supplier. And I know from my own experience that when I order something, I'm *positive* I'll remember who the order is for and who it was ordered from, until it doesn't show up and I have to back-track to find out what happened to it. Then I can never remember!

The manual seems to get weaker toward the end. For instance, you have to set the printer characteristics using ASCII codes. They do have a chart of the codes (without an explanation), and they do say, "This is probably the most difficult part of the system for inexperienced computer users to grasp...." But they don't do a whole lot to tell the user what he needs to do to access his printer properly. They do suggest that you consult your dealer if the printer doesn't interface with the program, but a little more explanation here would have helped.

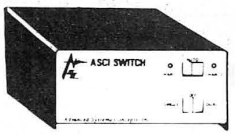
And, unfortunately, the system is not protected from a reset. If you do, says the manual, "your system will freeze, resulting in probable damage to your inventory database," and "a fatal, irrevocable error will occur." Since there are ways to reset-protect a program while it's in use, they should have been incorporated into the IMS program.

There's no doubt that Hayden's Inventory Management System will handle your inventory paperwork. It'll do it fast and with neat reports. If you can live with the restraints (and many businesses could), the system seems reasonably priced. If you can't, or you don't want to buy more disk drives as your inventory expands, then you're better off looking for a program designed more from a business standpoint.

(Hayden Book Co., 50 Essex St., Rochelle Park, NJ 07662. $175.)

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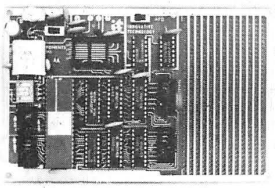
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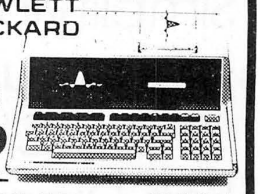
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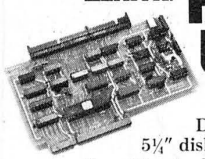
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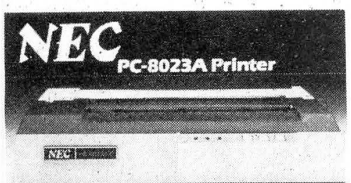
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Ampergraph

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Lets your Apple
Produce ample graphics

The graphics of the Apple II are excellent—even their competitors admit this. But the graphics routines that come with the machine are tedious to use.

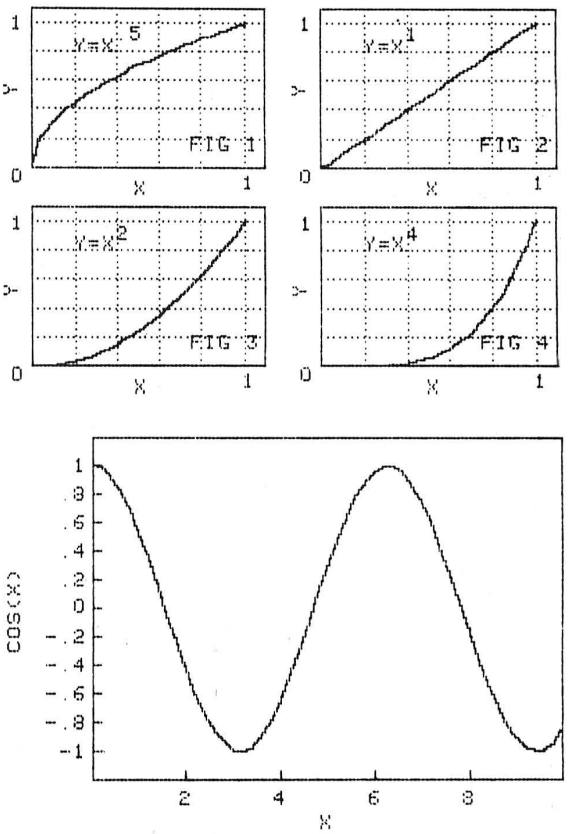
Many suppliers have recognized this weakness, and have produced various kinds of specialized programs to simplify specific graphics applications. One such supplier is Madwest Software.

Madwest Software has produced Ampergraph, a utility to draw graphs on the Apple II. Essentially, it adds 20 commands to Applesoft Basic. These commands simplify the job of drawing graphs, either on the CRT or on a printer—provided you have a Silentype printer, or are skillful enough with machine-language programming to find and modify Ampergraph's machine-language print routine.

Since Ampergraph uses commands embedded in an ordinary Applesoft Basic program, it is fairly easy to use. It can graph from mathematical formulae, or from numbers stored in DATA statements, or, for that matter, from both. You simply specify a series of x,y coordinates through an & DRAW command (ordinarily in a FOR I = n1 to n2 loop), and your Applesoft program does the rest.

You do have to specify scale values for the X and Y axes; but you can also label both the axes and the lines, draw several graphs on one page, draw one graph on just one part of the page, insert a grid on the graph, and insert "error bars" (helpful in statistical uses, for example, where it might be useful to show the standard deviation).

Ampergraph is specifically designed for line graphs, but it can also be used to draw bar graphs, though the procedure is awkward (you must draw the line up from the x axis, then horizontally, and finally back down to the x axis). Ampergraph could also draw pie graphs, or for that matter pictures which are not graphs; but for these applications, you're about as well off with the regular Apple II graphics.



This example demonstrates two features of Ampergraph: its ability to create grid lines and its ability to draw more than one graph at a time. It also illustrates, for the serious mathematician, one potential weakness of the Ampergraph utility—the x and y axes are not drawn on the same scale. This, of course, distorts the curves in an absolute sense, although the relative relationships of the curves are retained. The example is a modification (by the author) of the one on page 11 of the user's manual.

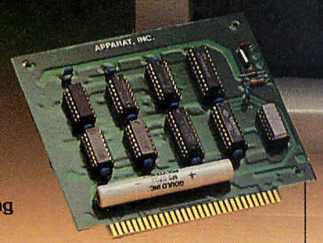
This example is taken from the Ampergraph user's manual, page 8. It shows a plot of the cosine of x, with x being the horizontal axis and y being the vertical axis. Notice that the label "COS(X)" is positioned vertically rather than horizontally.

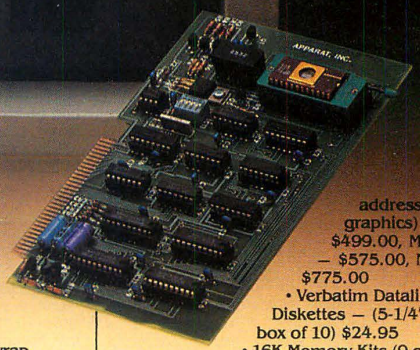
The Ampergraph user's manual is almost adequate. Programmers who have

(continued on page 151)

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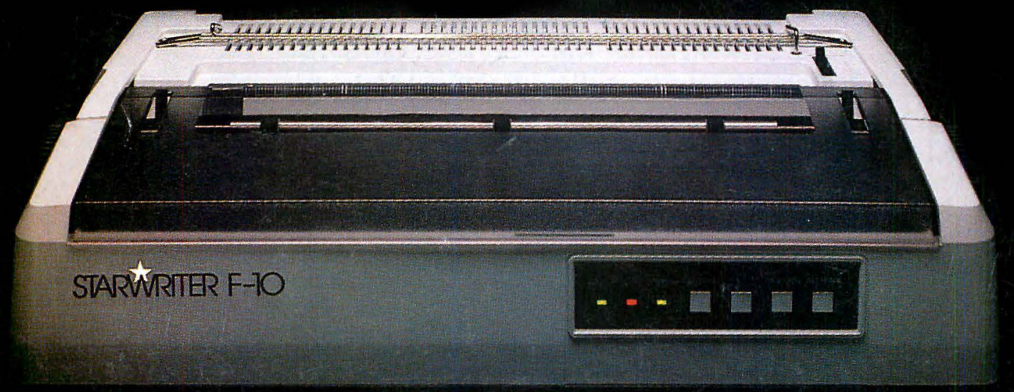
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